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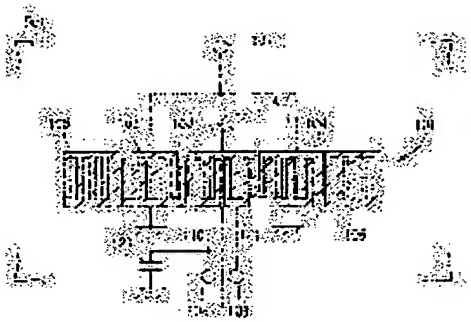
(54) SURFACE ACOUSTIC WAVE DEVICE AND COMMUNICATION APPARATUS

(57)Abstract:
PROBLEM TO BE SOLVED: To provide a surface acoustic wave device improved with respect to the phase balance and a communication apparatus using the same.
SOLUTION: A longitudinal coupled resonator type surface acoustic wave filter 101 having three IDTs formed in the propagating direction of surface acoustic waves is provided on a piezoelectric board 501. The IDT 103 located at the mid position among the three IDTs of the longitudinal coupled resonator type surface acoustic wave filter 101 is divided into two divisions approximately symmetrically to the propagating direction of the surface acoustic wave, and they are connected to balanced signal terminals 108, 109. The right and left IDTs 102, 104 having inverted polarities are connected to an unbalanced signal terminal 107 to obtain a balance-unbalance converting function. A reactance component 120 formed inside or outside a package is connected to either the balanced signal terminal 108 or 109 on the piezoelectric board 501.



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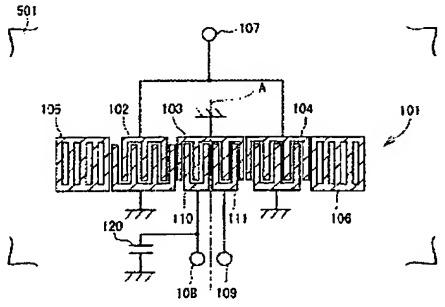
(54)【発明の名称】弾性表面波装置、通信装置

(57)【要約】
【課題】位相平衡が改善された弾性表面波装置及びそれを用いた通信装置を提供する。
【解決手段】圧電基板５０１上に弾性表面波の伝搬方向に沿って形成された３つのＩＤＴを有する縦結合共振子型弾性表面波フィルタ１０１を設ける。縦結合共振子型弾性表面波フィルタ１０１の３つのＩＤＴのうち中央に位置するＩＤＴ１０３を弾性表面波の伝搬方向に略対称に２分割してそれぞれを平衡信号端子１０８、１０９に接続する。極性を反転させた左右の各ＩＤＴ１０２、１０４を不平衡信号端子１０７に接続することで平衡－不平衡変換機能を持たせる。平衡信号端子１０８、１０９の何れかに対して、圧電基板５０１上に、パッケージ内部に、又はパッケージ内部の外に、形成したリアクタンス成分１２０を接続する。
【選択図】　図１



【特許請求の範囲】
【請求項１】
圧電基板上に弾性表面波の伝搬方向に沿って形成された３つ以上の奇数個のくし型電極部を有し、前記奇数個のくし型電極部のうち中央に位置するくし型電極部の一方のくし型電極を弾性表面波の伝搬方向に２分割してそれぞれが平衡信号端子に接続され、該中央に位置するくし型電極部に隣接する２つのくし型電極部は互いに反転した構造を有すると共に不平衡信号端子に接続されている平衡－不平衡変換機能を有する縦結合共振子型の弾性表面波フィルタを備えた弾性表面波装置において、
前記中央に位置するくし型電極部の最外電極指が浮き電極若しくは接地された電極であり、前記中央に位置するくし型電極部に隣接する２つのくし型電極部のうち、前記中央に位置するくし型電極部に隣接する最外電極指が接地されているくし型電極部に近い側に位置する平衡信号端子の方が相対的に寄生容量が大きくなるように、引き回し配線が非対称に形成されていることを特徴とする、弾性表面波装置。
【請求項２】
圧電基板上に弾性表面波の伝搬方向に沿って形成された３つ以上の奇数個のくし型電極部を有し、前記奇数個のくし型電極部のうち中央に位置するくし型電極部の一方のくし型電極を弾性表面波の伝搬方向に２分割してそれぞれが平衡信号端子に接続され、該中央に位置するくし型電極部に隣接する２つのくし型電極部は互いに反転した構造を有すると共に不平衡信号端子に接続されている平衡－不平衡変換機能を有する縦結合共振子型の弾性表面波フィルタを備えた弾性表面波装置において、
前記中央に位置するくし型電極部の最外電極指がシグナル電極であり、
前記中央に位置するくし型電極部に隣接する２つのくし型電極部のうち、前記中央に位置するくし型電極部に隣接する最外電極指がシグナル電極であるくし型電極部に近い側に位置する平衡信号端子の方が相対的に寄生容量が大きくなるように、引き回し配線が非対称に形成されていることを特徴とする、弾性表面波装置。
【請求項３】
前記圧電基板が、フリップチップボンディングでパッケージに搭載されており、前記非対称にした引き回し配線が該パッケージに形成されていることを特徴とする、請求項１又は２に記載の弾性表面波装置。
【請求項４】
前記中央に位置するくし型電極部の中心に、弾性表面波の伝搬方向に対し垂直方向に設けた仮想軸に対して、前記非対称な引き回し配線以外の前記圧電基板上及びパッケージの引き回し配線が略対称に形成されていることを特徴とする、請求項１ないし３の何れか１項に記載の弾性表面波装置。
【請求項５】
圧電基板上に弾性表面波の伝搬方向に沿って形成された３つ以上の奇数個のくし型電極部を有し、前記奇数個のくし型電極部のうち中央に位置するくし型電極部の一方のくし型電極を弾性表面波の伝搬方向に２分割してそれぞれが平衡信号端子に接続され、該中央に位置するくし型電極部に隣接する２つのくし型電極部は互いに反転した構造を有すると共に不平衡信号端子に接続されている平衡－不平衡変換機能を有する縦結合共振子型の弾性表面波フィルタを備えた弾性表面波装置において、
前記中央に位置するくし型電極部の最外電極指が浮き電極若しくは接地された電極であり、
前記中央に位置するくし型電極部に隣接する２つのくし型電極部のうち、前記中央に位置するくし型電極部に隣接する最外電極指が接地されているくし型電極部に近い側に位置する平衡信号端子にリアクタンス成分又は遅延線が付加されていることを特徴とする、弾性表面波装置。
【請求項６】
圧電基板上に弾性表面波の伝搬方向に沿って形成された３つ以上の奇数個のくし型電極部を有し、前記奇数個のくし型電極部のうち中央に位置するくし型電極部の一方のくし型電

極を弾性表面波の伝搬方向に２分割してそれぞれが平衡信号端子に接続され、該中央に位置するくし型電極部に隣接する２つのくし型電極部は互いに反転した構造を有すると共に不平衡信号端子に接続されている平衡－不平衡変換機能を有する縦結合共振子型の弾性表面波フィルタを備えた弾性表面波装置において、
前記中央に位置するくし型電極部の最外電極指がシグナル電極であり、
前記中央に位置するくし型電極部に隣接する２つのくし型電極部のうち、前記中央に位置するくし型電極部に隣接する最外電極指がシグナル電極であるくし型電極部に近い側に位置する平衡信号端子にリアクタンス成分又は遅延線が付加されていることを特徴とする、弾性表面波装置。

【請求項７】
前記圧電基板が、フリップチップボンディングでパッケージに搭載されており、前記リアクタンス成分又は遅延線が該パッケージに形成されていることを特徴とする、請求項５又は６に記載の弾性表面波装置。

【請求項８】
前記中央に位置するくし型電極部の中心に、弾性表面波の伝搬方向に垂直に設けた仮想軸に対して、前記リアクタンス成分又は遅延線以外の前記圧電基板上及びパッケージ上の引き回し配線が略対称に設定されていることを特徴とする、請求項５ないし７の何れか１項に記載の弾性表面波装置。

【請求項９】
前記リアクタンス成分が、キャパシタンス成分であり、前記平衡信号端子とアース電位との間に並列に接続されていることを特徴とする、請求項５ないし８の何れか１項に記載の弾性表面波装置。

【請求項１０】
前記リアクタンス成分が、インダクタンス成分であり、前記平衡信号端子に直列に接続されていることを特徴とする、請求項５ないし８の何れか１項に記載の弾性表面波装置。

【請求項１１】
前記弾性表面波フィルタに対して、直列及び／又は並列に弾性表面波共振子が付加されていることを特徴とする、請求項１ないし１０の何れか１項に記載の弾性表面波装置。

【請求項１２】
前記弾性表面波フィルタが、複数、互いにカスケード接続されていることを特徴とする、請求項１ないし１１の何れか１項に記載の弾性表面波装置。

【請求項１３】
前記カスケード接続した弾性表面波フィルタの総電極指本数が偶数本であることを特徴とする、請求項１２に記載の弾性表面波装置。

【請求項１４】
前記の互いにカスケード接続された各弾性表面波フィルタのそれぞれの両端に位置するくし型電極部が、シグナルラインを介してそれぞれ接続され、且つ該各シグナルラインを伝送する信号の位相が互いに約１８０度異なるように設定されていることを特徴とする、請求項１２又は１３に記載の弾性表面波装置。

【請求項１５】
前記弾性表面波フィルタのうち、互いに隣り合っているくし型電極部の少なくとも一方のくし型電極部における隣接部付近の電極指が重み付けされていることを特徴とする、請求項１ないし１４の何れか１項に記載の弾性表面波装置。

【請求項１６】
前記重み付けが直列重み付けであることを特徴とする、請求項１５に記載の弾性表面波装置。

【請求項１７】
前記圧電基板が、フリップチップボンディングでパッケージに搭載されており該パッケージの外部端子は、１つの不平衡信号端子、２つの平衡信号端子、３つのアース端子の６つであり、６つの端子が、前記弾性表面波フィルタの中央に位置するくし型電極部の中心に

弾性表面波の伝搬方向に対し垂直方向に設けた仮想軸に対して、略対称に配置されていることを特徴とする、請求項１ないし１６の何れか１項に記載の弾性表面波装置。
【請求項１８】
前記圧電基板が、フリップチップボンディングでパッケージに搭載されており該パッケージの外部端子は、１つの不平衡信号端子、２つの平衡信号端子、２つのアース端子の５つであり、５つの端子が、前記弾性表面波フィルタの中央に位置するくし型電極部の中心に弾性表面波の伝搬方向に対し垂直方向に設けた仮想軸に対して、略対称に配置されていることを特徴とする、請求項１ないし１６の何れか１項に記載の弾性表面波装置。
【請求項１９】
請求項１ないし１８の何れか１項に記載の弾性表面波装置を有していることを特徴とする、通信装置。
【発明の詳細な説明】
【０００１】
【発明の属する技術分野】
本発明は、平衡－不平衡変換機能を有する弾性表面波フィルタを備えた弾性表面波装置に関するものである。
【０００２】
【従来の技術】
近年の携帯電話機（通信装置）の小型化、軽量化に対する技術的進歩は目覚しいものがある。これを実現するための手段として、各構成部品の削減、小型化はもとより、複数の機能を複合した部品の開発も進んできた。
【０００３】
このような状況を背景に、携帯電話機のＲＦ段に使用する弾性表面波装置に平衡－不平衡変換機能、いわゆるバランの機能を持たせたものも近年盛んに研究され、ＧＳＭ（Ｇｌｏｂａｌ Ｓｙｓｔｅｍ ｆｏｒ Ｍｏｂｉｌｅ ｃｏｍｍｕｎｉｃａｔｉｏｎｓ）などを中心に使用されるようになってきた。
【０００４】
このような平衡－不平衡変換機能を持たせた弾性表面波装置に関する特許も、いくつか出願されている。図３に、特開平１１－９７９６６号公報に開示されている、不平衡信号端子側のインピーダンスが５０Ω、平衡信号端子側のインピーダンスが２００Ωに設定された平衡－不平衡変換機能を持たせた弾性表面波装置を示す。
【０００５】
図３の構成は、くし型電極部（Ｉｎｔｅｒ－Ｄｉｇｉｔａｌ Ｔｒａｎｓｄｕｃｅｒ、以下、ＩＤＴという）を、３つ、弾性表面波の伝搬方向に沿って有する縦結合共振子型弾性表面波フィルタ３０１において、中央に位置するＩＤＴ３０３を弾性表面波の伝搬方向に略対称に２分割してそれぞれを平衡信号端子３０８、３０９に接続し、極性を反転させた左右の各ＩＤＴ３０２、３０４を不平衡信号端子３０７に接続している。これにより、上記構成においては、極性の反転によって平衡－不平衡変換機能を持たせることができ、さらに平衡信号端子側のインピーダンスは、ＩＤＴ３０３の２分割により、不平衡信号端子側のインピーダンスの約４倍とすることができる。
【０００６】
平衡－不平衡変換機能を有するフィルタでは、不平衡信号端子と平衡信号端子のそれぞれの端子との間の通過帯域内での伝送特性において、振幅特性が等しく、かつ位相が１８０度反転していることが要求され、それぞれ振幅平衡度及び位相平衡度と呼んでいる。
【０００７】
振幅平衡度及び位相平衡度とは、前記平衡－不平衡変換機能を有するフィルタ装置を３ポートのデバイスと考え、例えば不平衡入力端子をポート１、平衡出力端子のそれぞれをポート２、ポート３としたときの、振幅平衡度＝｜Ａ｜、Ａ＝｜２０ｌｏｇ（Ｓ２１）｜－｜２０ｌｏｇ（Ｓ３１）｜、位相平衡度＝｜Ｂ－１８０｜、Ｂ＝｜∠Ｓ２１－∠Ｓ３１｜で定義する。このような平衡度は、理想的には弾性表面波フィルタの通過帯域内で振幅平

衡度が０ｄＢ、位相平衡度は０度とされる。

【０００８】

【発明が解決しようとする課題】

しかしながら、図３に示す従来の構成においては、平衡度が悪いという問題があった。その理由は、ＩＤＴ３０３と隣り合う電極指の極性がＩＤＴ３０２とＩＤＴ３０４とで互いに異なっており（図３の３１０と３１１）、これにより、各平衡信号端子３０８、３０９のそれぞれに入る寄生容量、橋絡容量等が互いに異なるためである。

【０００９】

本発明の目的は、図３の構成において上記の問題を解決し、平衡度を改善した平衡－不平衡変換機能を有し、かつ平衡信号端子のインピーダンスが不平衡信号端子のインピーダンスの約４倍である弾性表面波装置を提供することにある。

【００１０】

【課題を解決するための手段】

本発明の弾性表面波装置は、以上の課題を解決するために、圧電基板上に弾性表面波の伝搬方向に沿って形成された３つ以上の奇数個のくし型電極部を有し、前記奇数個のくし型電極部のうち中央に位置するくし型電極部の一方のくし型電極を弾性表面波の伝搬方向に２分割してそれぞれが平衡信号端子に接続され、該中央に位置するくし型電極部に隣接する２つのくし型電極部は互いに反転した構造を有すると共に不平衡信号端子に接続されている平衡－不平衡変換機能を有する縦結合共振子型の弾性表面波フィルタを備えた弾性表面波装置において、前記中央に位置するくし型電極部の最外電極指が浮き電極若しくは接地された電極であり、前記中央に位置するくし型電極部に隣接する２つのくし型電極部のうち、前記中央に位置するくし型電極部に隣接する最外電極指が接地されているくし型電極部に近い側に位置する平衡信号端子の方が相対的に寄生容量が大きくなるように、引き回し配線が非対称に形成されていることを特徴としている。

【００１１】

上記構成によれば、前記中央に位置するくし型電極部に隣接する２つのくし型電極部のうち、前記中央に位置するくし型電極部に隣接する最外電極指が接地されているくし型電極部に近い側に位置する平衡信号端子の方が相対的に寄生容量が大きくなるように、引き回し配線を非対称に形成することで、各平衡信号端子間の平衡度、特に位相平衡度を改善できる。

【００１２】

本発明の他の弾性表面波装置は、以上の課題を解決するために、圧電基板上に弾性表面波の伝搬方向に沿って形成された３つ以上の奇数個のくし型電極部を有し、前記奇数個のくし型電極部のうち中央に位置するくし型電極部の一方のくし型電極を弾性表面波の伝搬方向に２分割してそれぞれが平衡信号端子に接続され、該中央に位置するくし型電極部に隣接する２つのくし型電極部は互いに反転した構造を有すると共に不平衡信号端子に接続されている平衡－不平衡変換機能を有する縦結合共振子型の弾性表面波フィルタを備えた弾性表面波装置において、前記中央に位置するくし型電極部の最外電極指がシグナル電極であり、前記中央に位置するくし型電極部に隣接する２つのくし型電極部のうち、前記中央に位置するくし型電極部に隣接する最外電極指がシグナル電極であるくし型電極部に近い側に位置する平衡信号端子の方が相対的に寄生容量が大きくなるように、引き回し配線が非対称に形成されていることを特徴としている。

【００１３】

上記構成によれば、前記中央に位置するくし型電極部に隣接する２つのくし型電極部のうち、前記中央に位置するくし型電極部に隣接する最外電極指がシグナル電極であるくし型電極部に近い側に位置する平衡信号端子の方が相対的に寄生容量が大きくなるように、引き回し配線を非対称に形成することによって、各平衡信号端子間の平衡度、特に位相平衡度を改善できる。

【００１４】

上記弾性表面波装置では、前記圧電基板が、フリップチップボンディングでパッケージに

搭載されており、前記非対称にした引き回し配線が該パッケージに形成されていてもよい。

【００１５】

上記弾性表面波装置においては、前記中央に位置するくし型電極部の中心に、弾性表面波の伝搬方向に対し垂直方向に設けた仮想軸に対して、前記非対称な引き回し配線以外の前記圧電基板上及びパッケージの引き回し配線が略対称に形成されていてもよい。

【００１６】

本発明のさらに他の弾性表面波装置は、以上の課題を解決するために、圧電基板上に弾性表面波の伝搬方向に沿って形成された３つ以上の奇数個のくし型電極部を有し、前記奇数個のくし型電極部のうち中央に位置するくし型電極部の一方のくし型電極を弾性表面波の伝搬方向に２分割してそれぞれが平衡信号端子に接続され、該中央に位置するくし型電極部に隣接する２つのくし型電極部は互いに反転した構造を有すると共に不平衡信号端子に接続されている平衡－不平衡変換機能を有する縦結合共振子型の弾性表面波フィルタを備えた弾性表面波装置において、前記中央に位置するくし型電極部の最外電極指が浮き電極若しくは接地された電極であり、前記中央に位置するくし型電極部に隣接する２つのくし型電極部のうち、前記中央に位置するくし型電極部に隣接する最外電極指が接地されているくし型電極部に近い側に位置する平衡信号端子にリアクタンス成分又は遅延線が付加されていることを特徴としている。

【００１７】

上記構成によれば、中央に位置するくし型電極部に隣接する最外電極指が接地されているくし型電極部に近い側に位置する平衡信号端子にリアクタンス成分又は遅延線を付加したことで、各平衡信号端子間の平衡度、特に位相平衡度を改善できる。

【００１８】

本発明のさらに他の弾性表面波装置は、以上の課題を解決するために、圧電基板上に弾性表面波の伝搬方向に沿って形成された３つ以上の奇数個のくし型電極部を有し、前記奇数個のくし型電極部のうち中央に位置するくし型電極部の一方のくし型電極を弾性表面波の伝搬方向に２分割してそれぞれが平衡信号端子に接続され、該中央に位置するくし型電極部に隣接する２つのくし型電極部は互いに反転した構造を有すると共に不平衡信号端子に接続されている平衡－不平衡変換機能を有する縦結合共振子型の弾性表面波フィルタを備えた弾性表面波装置において、前記中央に位置するくし型電極部の最外電極指がシグナル電極であり、前記中央に位置するくし型電極部に隣接する２つのくし型電極部のうち、前記中央に位置するくし型電極部に隣接する最外電極指がシグナル電極であるくし型電極部に近い側に位置する平衡信号端子にリアクタンス成分又は遅延線が付加されていることを特徴としている。

【００１９】

上記構成によれば、中央に位置するくし型電極部の最外電極指がシグナル電極であり、前記中央に位置するくし型電極部に隣接する２つのくし型電極部のうち、前記中央に位置するくし型電極部に隣接する最外電極指がシグナル電極であるくし型電極部に近い側に位置する平衡信号端子にリアクタンス成分又は遅延線を付加したことによって、各平衡信号端子間の平衡度、特に位相平衡度を改善できる。

【００２０】

上記弾性表面波装置では、前記圧電基板が、フリップチップボンディングでパッケージに搭載されており、前記リアクタンス成分又は遅延線が該パッケージに形成されていてもよい。

【００２１】

上記弾性表面波装置においては、前記中央に位置するくし型電極部の中心に、弾性表面波の伝搬方向に垂直に設けた仮想軸に対して、前記リアクタンス成分又は遅延線以外の前記圧電基板上及びパッケージ上の引き回し配線が略対称に設定されていていてもよい。

【００２２】

上記弾性表面波装置では、前記リアクタンス成分が、キャパシタンス成分であり、前記平

衡信号端子とアース電位との間に並列に接続されていてもよい。上記弾性表面波装置においては、前記リアクタンス成分が、インダクタンス成分であり、前記平衡信号端子に直列に接続されていてもよい。

【００２３】

上記弾性表面波装置では、前記弾性表面波フィルタに対して、直列及び／又は並列に弾性表面波共振子が付加されていてもよい。上記弾性表面波装置においては、前記弾性表面波フィルタが、複数互いにカスケード接続されていてもよい。上記弾性表面波装置では、前記カスケード接続した弾性表面波フィルタの総電極指本数が偶数本であることが好ましい。

【００２４】

上記弾性表面波装置においては、前記の互いにカスケード接続された各弾性表面波フィルタのそれぞれの両端に位置するくし型電極部が、シグナルラインを介してそれぞれ接続され、且つ該各シグナルラインを伝送する信号の位相が互いに約１８０度異なるように設定されていることが望ましい。

【００２５】

上記弾性表面波装置では、前記弾性表面波フィルタのうち、互いに隣り合っているくし型電極部の少なくとも一方のくし型電極部における隣接部付近の電極指が重み付けされていてもよい。上記弾性表面波装置においては、前記重み付けが直列重み付けであってもよい。

【００２６】

上記弾性表面波装置においては、前記圧電基板が、フリップチップボンディングでパッケージに搭載されており該パッケージの外部端子は、１つの不平衡信号端子、２つの平衡信号端子、３つのアース端子の６つであり、６つの端子が、前記弾性表面波フィルタの中央に位置するくし型電極部の中心に弾性表面波の伝搬方向に対し垂直方向に設けた仮想軸に対して略対称に配置されていてもよい。

【００２７】

上記弾性表面波装置では、前記圧電基板が、フリップチップボンディングでパッケージに搭載されており該パッケージの外部端子は、１つの不平衡信号端子、２つの平衡信号端子、２つのアース端子の５つであり、５つの端子が、前記弾性表面波フィルタの中央に位置するくし型電極部の中心に弾性表面波の伝搬方向に対し垂直方向に設けた仮想軸に対して、略対称に配置されていてもよい。

【００２８】

本発明の通信装置は、前記の課題を解決するために、上記の何れかに記載の弾性表面波装置を有していることを特徴としている。上記構成によれば、平衡度に優れた弾性表面波装置を有しているから、通信特性を向上できる。

【００２９】

【発明の実施の形態】

本発明に係る弾性表面波装置の実施の一形態について図１に基づいて説明すれば、以下の通りである。本発明の弾性表面波装置は、図１に示すように、圧電基板５０１上に弾性表面波の伝搬方向に沿って形成された３つのＩＤＴを有する縦結合共振子型弾性表面波フィルタ１０１を備え、前記縦結合共振子型弾性表面波フィルタ１０１の３つのＩＤＴのうち中央に位置するＩＤＴ１０３を弾性表面波の伝搬方向に略対称に２分割してそれぞれを平衡信号端子１０８、１０９に接続し、極性を反転させた左右のＩＤＴ１０２、１０４を不平衡信号端子１０７に接続することで平衡－不平衡変換機能を持たせた弾性表面波装置において、前記平衡信号端子１０８、１０９の何れかに、圧電基板上に形成した、又はパッケージに形成した、もしくはパッケージに外付けしたリアクタンス成分１２０を並列に接続したことを特徴としている。

【００３０】

上記構成においては、平衡－不平衡変換機能を有し、かつ平衡信号端子のインピーダンスが不平衡信号端子のインピーダンスの約４倍であり、さらに、リアクタンス成分１２０に

よって平衡度を改善した弾性表面波装置が得られる。

【００３１】

【実施例】

（実施例１）

図４ないし図７を用いて、本発明に係る実施例１の構成を説明する。なお、以後の実施例では、ＤＣＳ受信用フィルタを例にとって説明を行っていく。まず、図４を用いて、実施例１の電極構成について説明する。実施例１では４０±５°ＹｃｕｔＸ伝搬ＬｉＴａＯ３からなる圧電基板５０１上に、縦結合共振子型弾性表面波フィルタ４０１、及び縦結合共振子型弾性表面波フィルタ４０１に直列に接続された弾性表面波共振子４０２が、アルミニウム（Ａｌ）電極により、それぞれ形成されている。

【００３２】

縦結合共振子型弾性表面波フィルタ４０１の構成は、ＩＤＴ４０４を弾性表面波の伝搬方向に沿って両側から挟み込むように各ＩＤＴ４０３、４０５がそれぞれ形成され、さらにそれらの両側に各リフレクタ４０６、４０７がそれぞれ形成されている。

【００３３】

ＩＤＴ４０３は、帯状の基端部（バスバー）と、その基端部の一方の側部から直交する方向に延びる複数の、互いに平行な電極指とを備えたくし型電極を２つ備えており、上記各くし型電極の電極指の側部を互いに対面するように互いの電極指間に入り組んだ状態にて上記各くし型電極を有するものである。

【００３４】

このようなＩＤＴ４０３では、各電極指の長さや幅、隣り合う各電極指の間隔、互いの電極指間での入り組んだ状態の対面長さを示す交叉幅を、それぞれ設定することにより信号変換特性や、通過帯域の設定が可能となっている。また、他の各ＩＤＴについても、ＩＤＴ４０３と基本的な構造は同様である。リフレクタは、伝搬してきた弾性表面波を伝搬してきた方向に反射する機能を有するものである。

【００３５】

その上、上記構成では、図４を見るとわかるように、ＩＤＴ４０３とＩＤＴ４０４との間近傍、及びＩＤＴ４０４とＩＤＴ４０５との間近傍における数本の電極指のピッチを、ＩＤＴの他の部分よりも小さくしている（図４の４１４、４１５の箇所）。

【００３６】

さらに、中央のＩＤＴ４０４における一方のくし型電極は、弾性表面波の伝搬方向に２分割されて各くし型電極４１６、４１７となっており、それぞれのくし型電極４１６、４１７が各平衡信号端子４１２、４１３に接続されている。また、本実施例１では、ＩＤＴ４０４における、くし型電極４１６、４１７と異なる、それらと対面している他方のくし型電極は、浮き電極としているが、アースに接地されたアース電極でもよい。ＩＤＴ４０５は、ＩＤＴ４０３に対して位相反転した構造となっている。これにより、上記構成は、平衡－不平衡変換機能を有している。

【００３７】

弾性表面波共振子４０２は、ＩＤＴ４０８を挟み込むように、各リフレクタ４０９、４１０がそれぞれ形成されており、ＩＤＴ４０８の一方のくし型電極が不平衡信号端子４１１に、ＩＤＴ４０８の他方のくし型電極が各ＩＤＴ４０３、４０５に接続されている。

【００３８】

図５に実施例１の、実際の圧電基板５０１上のレイアウトを示す。図５において、図４に対応する箇所は同じ番号を用いて示している。上記レイアウトでは、パッケージと導通を取るための各電極パッド５０２～５０６が設けられ、電極パッド５０２が不平衡信号端子４１１に対応するものであり、各電極パッド５０３、５０４がそれぞれ平衡信号端子４１２、４１３に相当するものであり、各電極パッド５０５、５０６がアース端子であり、各ＩＤＴは簡略化して図示されている。

【００３９】

図６に、実施例１の構成を収納した、略直方体形状のパッケージ６４０の裏面（長方形状

）６４０ａ側の各電極端子６４１～６４５をそれぞれ示す（弾性表面波装置（デバイス）の上面側から見た透視図で示している）。電極端子６４１は、裏面６４０ａの長手方向における一方の端部の略中央に配置されている。各電極端子６４２、６４３は、裏面６４０ａの長手方向における他方の端部の両隅部にそれぞれ配置されている。各電極端子６４４、６４５は、裏面６４０ａの長手方向における両測部の略中央にそれぞれ配置されている。

【００４０】

電極端子６４１が電極パッド５０２に接続される不平衡信号端子、各電極端子６４２、６４３がそれぞれ各電極パッド５０３、５０４に接続される平衡信号端子、各電極端子６４４、６４５がそれぞれ各電極端子５０５、５０６に接続されるアース端子である。

【００４１】

実施例１の弾性表面波装置は、図７に示すように、圧電基板５０１の電極面とパッケージ６４０のダイアタッチ面６５３との間をバンプ６５６で導通を取るフェイスダウン工法を用いて作製されている。

【００４２】

パッケージ６４０は、長方形板状の底板６５１と、底板６５１の各辺部からそれぞれ互いに隣接して立設された各側壁部６５２と、各側壁部６５２の各上端部を密着して覆ってパッケージ６４０内を封止するためのキャップ６５４とを有している。

【００４３】

実施例１の特徴は、図５に示すように、くし型電極４１７と電極パッド５０４とを接続する、帯状の引き回し配線５０８において、くし型電極４１６と電極パッド５０３とを接続する、帯状の引き回し配線５０７に対して、図１に示すリアクタンス成分１２０に相当する対地容量が大きくなるようにしている点である。

【００４４】

このように対地容量を大きくするため、本実施例１では、突出部５０９が、引き回し配線５０８から圧電基板５０１上にて外方に突出するように追加して設けられている。

【００４５】

突出部５０９は、アース側の電極パッド５０６とＩＤＴ４０５とを接続する引き回し配線５１１に近接した位置の引き回し配線５０８から形成されていることが好ましい。

【００４６】

また、突出部５０９は、上記引き回し配線５０８の長手方向に対して略直交し、上記引き回し配線５１１の長手方向に対して略平行に上記引き回し配線５１１と離間して伸びるように設けられていることが望ましい。

【００４７】

上記突出部５０９により、図４に示す、平衡信号端子４１３の対地容量は、平衡信号端子４１２より、例えば約０．１６ｐＦだけ大きくなることになり、よって、各引き回し配線５０８、５１１は、互いに非対称に形成されていることになる。

【００４８】

このとき、ＩＤＴ４０４（各くし型電極４１６、４１７）における、各ＩＤＴ４０３、４０５と隣り合っている電極指はそれぞれシグナル電極である。対地容量が大きくなる引き回し配線にしている電極パッド５０４に接続されているくし型電極４１７と、隣り合っているＩＤＴ４０５の電極指もシグナル電極である。一方、電極パッド５０３に接続されているくし型電極４１６と隣り合っているＩＤＴ４０３の電極指はアース電極である。

【００４９】

さらに、実施例１では、突出部５０９の非対称性以外の構成は、図４ないし図６に示した、２分割したＩＤＴ４０４を中心に、弾性表面波の伝搬方向に対して垂直方向に設けた仮想軸Ａに対して、圧電基板５０１上のレイアウト、パッケージ６４０のすべてが軸対称になるように設定されている。これにより、ＩＤＴ４０４と隣り合う電極指の極性がＩＤＴ４０３とＩＤＴ４０５とで互いに異なっている点以外の不平衡成分が入らないようにしている。

【００５０】
縦結合共振子型弾性表面波フィルタ４０１の詳細な設計は、ピッチを小さくしていない電極指のピッチで決まる波長をλＩとすると、
交叉幅：７８．９λＩ
ＩＤＴ本数（４０３、４０４、４０５の順）：１９（３）／（３）２６（３）／（３）１９本（カッコ内はピッチを小さくした電極指の本数）
リフレクタ本数：２００本
ｄｕｔｙ：０．６７（ＩＤＴ、リフレクタ共）
電極膜厚：０．０９５λＩ
弾性表面波共振子４０２の詳細な設計は、以下のとおりである。
交叉幅：４６．５λＩ
ＩＤＴ本数：１５０本
リフレクタ本数：１００本
ｄｕｔｙ：０．６７
電極膜厚：０．０９７λＩ
次に、本実施例１の構成に関する作用・効果を説明する。図８に、実施例１の構成の位相平衡度を示す。比較としての比較例１は、図９に示すように、圧電基板５０１上のレイアウトを図５の実施例１に対して、引き回し配線５０８に対地容量が大きくなる箇所である突出部５０９を設けず、引き回し配線５０８を引き回し配線５０７と仮想軸Ａに対して軸対称に設定した以外は、実施例１の構成と弾性表面波装置の設計、圧電基板５０１上のレイアウト、パッケージの実装方法等、すべて同じである。圧電基板５０１上のレイアウトを突出部無に変更した比較例１の位相平衡度も合わせて図８に示す。
【００５１】
ＤＣＳ受信用フィルタの通過帯域は、１８０５ＭＨｚ～１８８０ＭＨｚである。この通過帯域の範囲内における位相平衡度のずれは、図８によると、比較例１では最大約２２度であるのに対し、実施例１では最大約１２度と、約１０度位相平衡度が改善されている。これは平衡信号端子４１３の対地容量が大きくなるように調整することで、平衡信号端子４１２と平衡信号端子４１３との間における位相のずれが補正された効果である。
【００５２】
実施例１では、引き回し配線５０８に対地容量が大きくなる箇所である突出部５０９を設けた。次に、これとは逆に、図１０のように引き回し配線５０７に対地容量が大きくなる箇所としての突出部５１５を設け、平衡信号端子４１２の対地容量が約０．１６ｐＦ大きくなった場合における位相平衡度を調査した。図１０の場合の位相平衡度を図１１に示す。比較として、図９に示した比較例１の場合の結果も図１１に合わせて示す。
【００５３】
平衡信号端子４１２の対地容量が大きくなるようにした場合、逆に比較例１よりも位相平衡度が悪化している。どちらの平衡信号端子の対地容量を大きくするかは、ＩＤＴ４０２～４０４の、互いに隣り合う電極指の並び方、つまりシグナル電極同士、又はアース電極同士が互いに隣り合う無電界領域の有無により決めればよい。
【００５４】
実施例１の場合は、ＩＤＴ４０４における、各ＩＤＴ４０３、４０５と隣り合っている電極指は、各くし型電極４１６、４１７の各シグナル電極である。一方、対地容量が大きくなる引き回し配線にしている、電極パッド５０４に接続されているくし型電極４１７と隣り合っているＩＤＴ４０５における、ＩＤＴ４０４と隣り合っている電極指は、シグナル電極であり、対面するくし型電極４１７の最外電極指であるシグナル電極と無（小）電界領域を形成する。一方、電極パッド５０３に接続されているくし型電極４１６と隣り合っているＩＤＴ４０３における、ＩＤＴ４０４と隣り合っている電極指は、アース電極であり、対面するくし型電極４１６の最外電極指であるシグナル電極と、上記無（小）電界領域より電界が大きいことが多い電界領域を形成する。
【００５５】

このような電極指の並びの場合、実施例１のように、無電界領域を最外電極指の近傍に（又は、上記最外電極指に面して）有するくし型電極４１７に接続されている平衡信号端子４１３の対地容量を、くし型電極４１６に接続されている平衡信号端子４１２より相対的に大きくなるように、例えば突出部５０９によって設定することで、位相平衡度を改善することができる。

【００５６】

次に、図１２のように、ＩＤＴ７０４の各ＩＤＴ７０３、７０５とそれぞれ隣り合っている各電極指が中性点電極（浮き電極でもアース電極でもよい）である場合について調査した。図１３に、図１２の電極構成の場合における図１０に示す圧電基板５０１上のレイアウトの場合（実施例１の一変形例）の位相平衡度を示し、図１４に、図１２の電極構成の場合における図５に示すレイアウトの場合（比較例３）の位相平衡度を示す。比較例２として、図１２の電極構成の場合における図９に示すレイアウト（突出部無）の場合における位相平衡度もそれぞれ比較例２として、図１３及び図１４に合わせて示す。図１３及び図１４は、突出部５１５、及び突出部５０９の箇所に約０．０２ｐＦの対地容量が入るようにそれぞれ調整した場合の結果である。

【００５７】

図１２に示す電極指の並びの場合、図１０に示すレイアウトのように、くし型電極７１６に接続されている平衡信号端子７１２の対地容量を、くし型電極７１７に接続されている平衡信号端子７１３より相対的に大きくなるようにすることで、位相平衡度が改善されていることがわかる。

【００５８】

次に、図１２の電極構成において、各平衡信号端子に対し不平衡に、遅延線、及びインダクタンス成分を直列にそれぞれ付加した場合の位相平衡度をそれぞれ調査した。

【００５９】

図１５に、くし型電極７１６に接続されている平衡信号端子７１２に対して、図１に示すリアクタンス成分１２０としての遅延線７２０を付加した構成（実施例１の他の変形例）を示し、図１６に、図１に示すリアクタンス成分１２０としてのインダクタンス成分７２２を付加した構成（実施例１のさらに他の変形例）を示す。

【００６０】

図１５及び図１６の各構成における場合の位相平衡度を図１７及び図１８に示す。比較として、図１２の構成における図９のレイアウトで遅延線もインダクタンス成分も付加していない場合の位相平衡度も比較例２として、図１７及び図１８にそれぞれ合わせて示す。

【００６１】

上記の遅延線７２０やインダクタンス成分７２２の具体的な形成方法は省略するが、例えば圧電基板上やパッケージ内の引き回し配線を長くした遅延線を設けたり、マイクロストリップ線路によるインダクタンス成分を設けたりすることが考えられる。

【００６２】

また、可能であれば、例えば図３１（ａ）及び図３１（ｂ）にそれぞれ示すように、パッケージ内部以外の外の位置に外付けしてもよい。図３１（ａ）では、側壁部６５２と底板６５１との境界部分に、遅延線や、インダクタンス成分（リアクタンス成分）となる回路６５５が設けられ、図３１（ｂ）においては、底板６５１上に積層板６５７と、積層板６５７にその厚さ方向にビアホール６５８と、ビアホール６５８を介して接続され、底板６５１及び積層板６５７の間に形成された遅延線や、インダクタンス成分となる回路６５９とが設けられてもよい。

【００６３】

図１７及び図１８から明らかなように、遅延線７２０、インダクタンス成分７２２のいずれを挿入した場合においても、位相平衡度は比較例２に対して改善していることがわかる。なお、図４の電極構成においては、逆に平衡信号端子４１３に対して、遅延線７２０、又はインダクタンス成分７２２を付加してやればよい。

【００６４】

以上説明したように、実施例１では、圧電基板上に弾性表面波の伝搬方向に沿って形成された３つのＩＤＴを有する縦結合共振子型弾性表面波フィルタを有し、３つのＩＤＴのうち中央に位置するＩＤＴを弾性表面波の伝搬方向に２分割し、左右のＩＤＴの極性を反転させることで平衡－不平衡変換機能を持たせた弾性表面波装置において、対地容量、直列に接続するインダクタンス成分、及び遅延線の少なくとも一つであるリアクタンス成分を、２つの各平衡信号端子間で非対称とすることで、弾性表面波装置の位相平衡度を改善することができる。

【００６５】

実施例１で対地容量を大きくする方法として、図５に示すように、圧電基板５０１上のシグナル電極をアース電極に近づける方法を示したが、これは図１９のようにくし型電極で容量５１７を形成してもよい。また、パッケージ６４０内の引き回し配線を調整してもよい。

【００６６】

また、実施例１では、余計な不平衡成分をなくすために平衡信号端子に対して、非対称に対地容量、インダクタンス成分、遅延線を付加する以外は、圧電基板５０１上のレイアウト、パッケージ６４０等は同じになるようにした。そのため、パッケージ６４０の裏面６４０ａ側における各電極端子６４１～６４５の数が５つの場合の例（図６参照）を示したが、本発明はこのようなパッケージに限らず、２分割した中央ＩＤＴを中心に弾性表面波の伝搬方向に垂直に引いた仮想軸Ａに対して軸対称にできるパッケージであれば、どのようなパッケージを用いてもよい。

【００６７】

例えば図２０のように６つの電極端子８０１～８０６を有するパッケージ８００の場合、電極端子８０１を不平衡信号端子、各電極端子８０２、８０３を平衡信号端子とし、各電極端子８０４～８０６をアース端子とすることで、仮想軸Ａに対して軸対称とすることができる。

【００６８】

その際、圧電基板５０１上のパターンレイアウトは図２１のように、弾性表面波の伝搬方向を圧電基板５０１の長辺方向に沿ったものとし、圧電基板５０１上の電極パッド９０１を電極端子８０１に、電極パッド９０２を電極端子８０２に、電極パッド９０３を電極端子８０３に接続し、各電極パッド９０４～９０６をアース端子となる各電極端子８０４～８０６にそれぞれ接続することで、圧電基板５０１上も容易に仮想軸Ａに対して軸対称とすることができる。

【００６９】

また、実施例１では図７のように、フェイスダウン工法でパッケージと圧電基板の導通を取る方法で弾性表面波装置を作製したが、これはワイヤボンド工法であっても問題はない。

【００７０】

また、フェイスダウン工法で作製する構成としては図７の構成に限らず、例えば図２２のように集合基板１００１上に圧電基板１００２をフリップチップ工法で接合し、その上に樹脂１００３を覆って封止して、ダイシングにより１パッケージ単位に切断する構成、図２３のように同じく集合基板１１０１上に圧電基板１１０２をフリップチップ工法で接合し、その上にシート状の樹脂材１１０３を覆って封止して、ダイシングにより１パッケージ単位に切断する構成で、弾性表面波装置が作製されていてもよい。

【００７１】

実施例１では、３つのＩＤＴを有する縦結合共振子型弾性表面波フィルタに、弾性表面波共振子を直列接続した構成を示したが、弾性表面波共振子が接続されていない構成や、さらには並列接続された構成においても、同様な効果が得られることは明らかである。また、図２４のように、３つのＩＤＴの両側に、さらにＩＤＴを設けた、５ＩＤＴの縦結合共振子型の構成であってもよい。

【００７２】

また、図２５のように、ＩＤＴが隣り合っている付近の電極指１３０に対して重み付けを施してあっても、本発明の効果は得られる。図２５の構成においては、さらに平衡度が改善される。重み付けの例として、図２５では直列重み付けを用いているが、これは間引き重み付け、交叉幅重み付け、ｄｕｔｙ重み付けであってもよい。

【００７３】

また、本発明では、図２のように、縦結合共振子型弾性表面波フィルタ１０１に、他の縦結合共振子型弾性表面波フィルタ２０１をカスケード接続した構成であってもよい。その際、縦結合共振子型弾性表面波フィルタ２０１の中央部に位置するＩＤＴ２０３は、総電極指本数が偶数本であることが望ましい。

【００７４】

また、縦結合共振子型弾性表面波フィルタ１０１と縦結合共振子型弾性表面波フィルタ２０１とを互いに接続している各シグナルライン２０５、２０６を伝送する信号の位相が約１８０度異なるように、各ＩＤＴ１０２、１０４、及び各ＩＤＴ２０２、２０４の向きを調整しておくことが望ましい。上記の構成にすることで、さらに平衡度の優れた弾性表面波装置が得られる。

【００７５】

図２の電極構成を用いる場合の圧電基板５０１上におけるレイアウトの例を、図６に示す５つの各電極端子を有するパッケージに実装する場合について図２６、図２７に、また、図２０に示す６つの電極端子を有するパッケージに実装する場合について、図２８、図２９に示す。

【００７６】

その際、各電極パッド１２０１、１３０１、１４０１、１５０１は不平衡信号端子、各電極パッド１２０２、１２０３、１３０２、１３０３、１４０２、１４０３、１５０２、１５０３を平衡信号端子に、残りをアース端子に接続する構成になる。

【００７７】

実施例１では、４０±５°ＹｃｕｔＸ伝搬ＬｉＴａＯ３基板を圧電基板５０１として用いたが、効果が得られる原理からもわかるとおり、本発明はこの圧電基板５０１に限らず、６４°～７２°ＹｃｕｔＸ伝搬ＬｉＮｂＯ３、４１°ＹｃｕｔＸ伝搬ＬｉＮｂＯ３などの圧電基板でも同様な効果が得られる。

【００７８】

次に、本発明に係る、上記の実施例１及びその各変形例の何れか、又はそれらの特徴の組み合わせとなる、本発明の弾性表面波装置を用いた通信装置について図３０に基づき説明する。

【００７９】

図３０に示すように、上記通信装置６００は、受信を行うレシーバ側（Ｒｘ側）として、アンテナ６０１、アンテナ共用部／ＲＦＴｏｐフィルタ６０２、アンプ６０３、Ｒｘ段間フィルタ６０４、ミキサ６０５、１ｓｔＩＦフィルタ６０６、ミキサ６０７、２ｎｄＩＦフィルタ６０８、１ｓｔ＋２ｎｄローカルシンセサイザ６１１、ＴＣＸＯ（ｔｅｍｐｅｒａｔｕｒｅ ｃｏｍｐｅｎｓａｔｅｄ ｃｒｙｓｔａｌ ｏｓｃｉｌｌａｔｏｒ（温度補償型水晶発振器））６１２、デバイダ６１３、ローカルフィルタ６１４を備えて構成されている。Ｒｘ段間フィルタ６０４からミキサ６０５へは、図３０に二本線で示したように、バランス性を確保するために各平衡信号にて送信することが好ましい。

【００８０】

また、上記通信装置６００は、送信を行うトランシーバ側（Ｔｘ側）として、上記アンテナ６０１及び上記アンテナ共用部／ＲＦＴｏｐフィルタ６０２を共用するとともに、ＴｘＩＦフィルタ６２１、ミキサ６２２、Ｔｘ段間フィルタ６２３、アンプ６２４、カプラ６２５、アイソレータ６２６、ＡＰＣ（ａｕｔｏｍａｔｉｃ ｐｏｗｅｒ ｃｏｎｔｒｏｌ（自動出力制御））６２７を備えて構成されている。

【００８１】

そして、上記のＲｘ段間フィルタ６０４、１ｓｔＩＦフィルタ６０６、ＴｘＩＦフィルタ

６２１、Ｔｘ段間フィルタ６２３、アンテナ共用部／ＲＦＴｏｐフィルタ６０２には、上述した本実施例の弾性表面波装置が好適に利用できる。

【００８２】

本発明に係る弾性表面波装置は、フィルタ機能と共に不平衡－平衡変換機能を備え、その上、各平衡信号間の振幅特性や位相特性が理想により近いという優れた特性を有するものである。よって、上記弾性表面波装置を有する本発明の通信装置は、複合化された上記弾性表面波装置を用いたことにより、構成部品数を低減できて小型化できると共に、伝送特性を向上できるものとなっている。

【００８３】

【発明の効果】

以上説明したように、本発明の弾性表面波装置は、圧電基板上に弾性表面波の伝搬方向に沿って形成された３つのＩＤＴを有する縦結合共振子型弾性表面波フィルタであり、前記縦結合共振子型弾性表面波フィルタの３つのＩＤＴのうち中央に位置するＩＤＴを弾性表面波の伝搬方向に略対称に２分割してそれぞれを平衡信号端子に接続し、極性を反転させた左右のＩＤＴを不平衡信号端子に接続することで平衡－不平衡変換機能を持たせた弾性表面波装置において、前記各平衡信号端子のいずれかに、圧電基板上に、パッケージに、及びパッケージに外付けの少なくとも一つにリアクタンス成分が接続されている構成である。

【００８４】

それゆえ、上記構成は、各平衡信号端子のいずれかに対して、リアクタンス成分を接続することにより、各平衡信号端子間の平衡度を改善できるという効果を奏する。

【図面の簡単な説明】

【図１】本発明の弾性表面波装置の構成図である。

【図２】上記弾性表面波装置の一変形例（カスケード接続）の構成図である。

【図３】従来の弾性表面波装置の構成図である。

【図４】本発明の実施例１に係る弾性表面波装置の電極構成を示す構成図である。

【図５】上記実施例１の弾性表面波装置における圧電基板上でのレイアウトを示す平面図である。

【図６】上記実施例１の弾性表面波装置を収納したパッケージの裏面側での各端子の配置を、パッケージの上面（裏面の対向面）側からの透視図にてそれぞれ示す平面図である。

【図７】上記実施例１の弾性表面波装置を収納したパッケージの断面図である。

【図８】上記実施例１及び比較例１の各構成での位相平衡度をそれぞれ示すグラフである。

【図９】上記比較例１の弾性表面波装置のレイアウトを示す平面図である。

【図１０】比較例２としての弾性表面波装置のレイアウトを示す平面図である。

【図１１】図１０に示す構成（比較例２）及び上記比較例１の各構成での位相平衡度をそれぞれ示すグラフである。

【図１２】上記実施例１の一変形例としての弾性表面波装置に関する電極構成を示す構成図である。

【図１３】図１２の電極構成を図１０の圧電基板上のレイアウトで構成した場合、及び比較例２の周波数－位相平衡度をそれぞれ示すグラフである。

【図１４】図１２の電極構成を図５の圧電基板上のレイアウトで構成した場合、及び比較例２の周波数－位相平衡度をそれぞれ示すグラフである。

【図１５】上記実施例１の他の変形例の弾性表面波装置を示す構成図である。

【図１６】上記実施例１のさらに他の変形例の弾性表面波装置を示す構成図である。

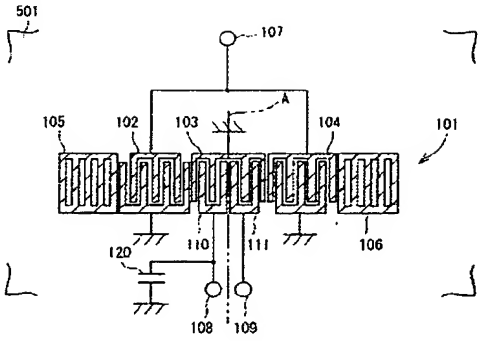
【図１７】図１５の構成、及び比較例２の周波数－位相平衡度をそれぞれ示すグラフである。

【図１８】図１６の構成、及び比較例２の周波数－位相平衡度をそれぞれ示すグラフである。

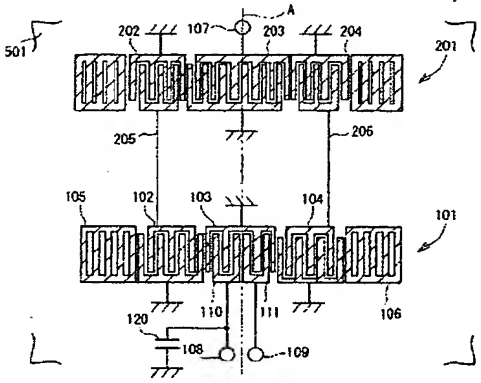
【図１９】上記実施例１のさらに他の変形例の弾性表面波装置を示す構成図である。

【図２０】上記実施例１のパッケージにおける各電極端子の配置に関する他の例を示す平面図である。
【図２１】上記実施例１の弾性表面波装置のさらに他の変形例を示す構成図である。
【図２２】上記実施例１の弾性表面波装置の、一製造プロセスを示す断面図である。
【図２３】上記実施例１の弾性表面波装置の、他の製造プロセスを示す断面図である。
【図２４】上記実施例１の弾性表面波装置のさらに他の変形例を示す構成図である。
【図２５】上記実施例１の弾性表面波装置のさらに他の変形例を示す構成図である。
【図２６】前記図２に示す電極構成を、図６に示す、裏面側の各電極端子を有するパッケージに実装する際の、圧電基板上のレイアウトの一例を示す平面図である。
【図２７】上記図２に示す電極構成を、図６に示す、裏面側の各電極端子を有するパッケージに実装する際の、圧電基板上のレイアウトの他の例を示す平面図である。
【図２８】前記図２に示す電極構成を、図２０に示す、裏面側の各電極端子を有するパッケージに実装する際の、圧電基板上のレイアウトの一例を示す平面図である。
【図２９】前記図２に示す電極構成を、図２０に示す、裏面側の各電極端子を有するパッケージに実装する際の、圧電基板上のレイアウトの他の例を示す平面図である。
【図３０】本発明に係る通信装置の要部ブロック図である。
【図３１】上記実施例１の弾性表面波装置をパッケージに収納した際の、リアクタンス成分又は遅延線がパッケージに外付けされた場合の、上記パッケージの断面図であり、（ａ）は、底板と側壁部との間に上記リアクタンス成分又は遅延線としての回路が形成された例であり、（ｂ）は、底板上にさらに積層板を形成した多層板内に上記リアクタンス成分又は遅延線が回路として形成された例である。
【符号の説明】
１０１　縦結合共振子型弾性表面波フィルタ
１０２、１０３、１０４　ＩＤＴ（くし型電極部）
１０７　不平衡信号端子
１０８、１０９　平衡信号端子
１２０　リアクタンス成分
５０１　圧電基板

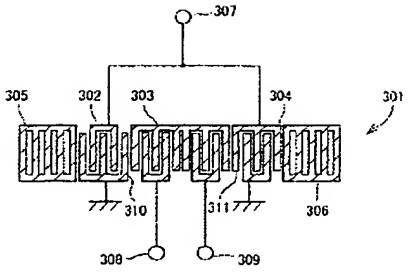
【図１】



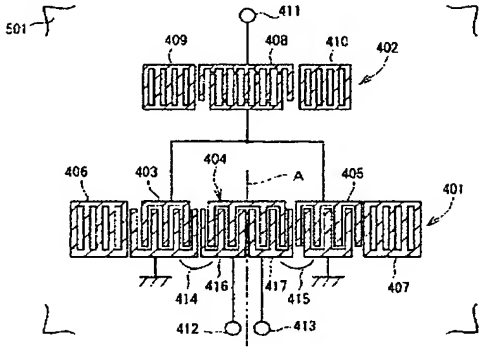
【図２】



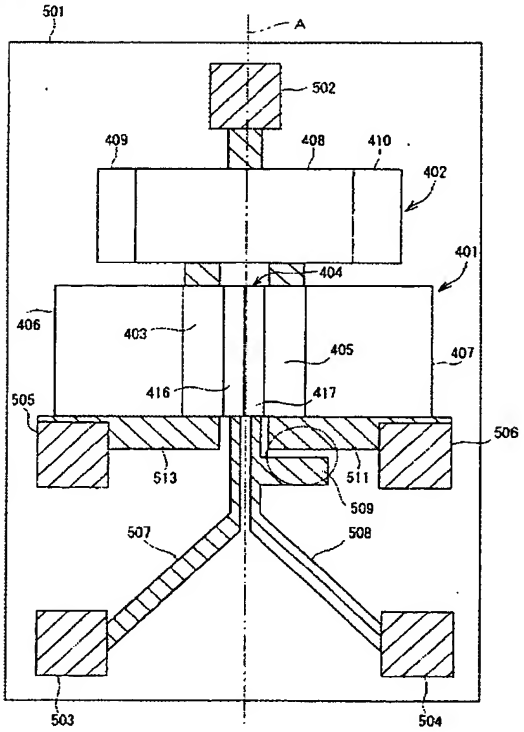
【図３】



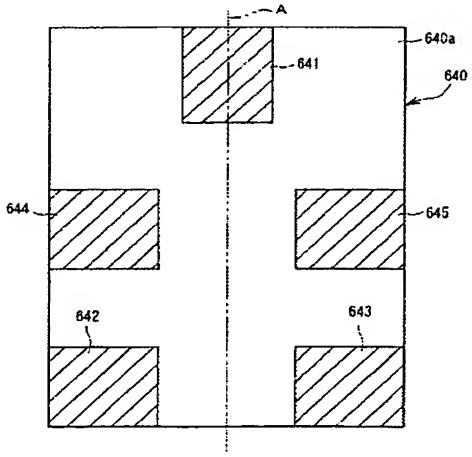
【図４】



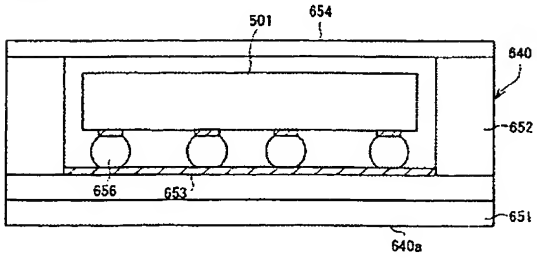
【図５】



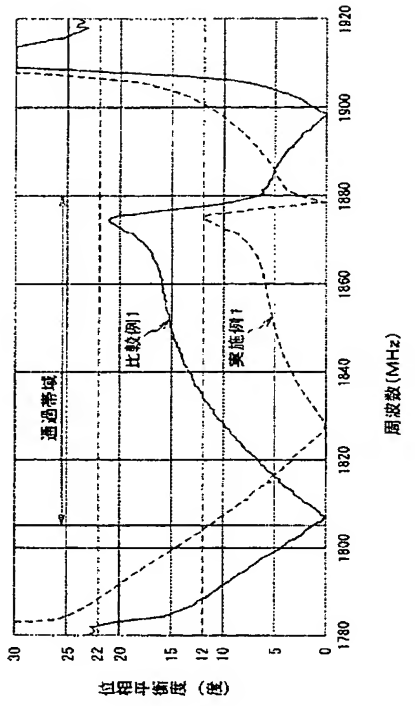
【図６】



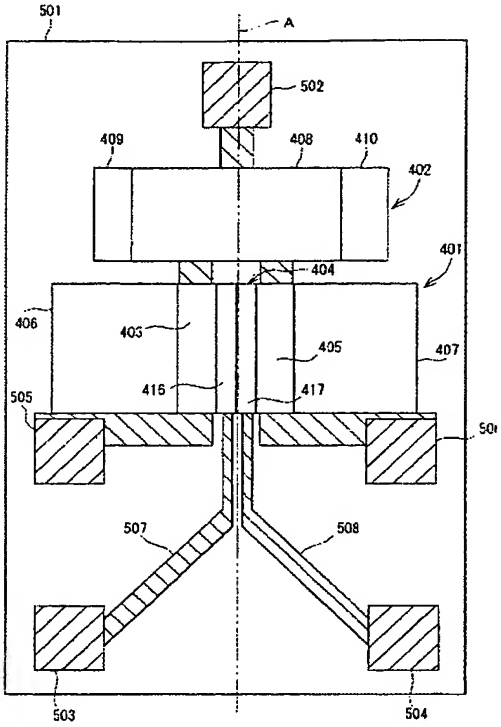
【図７】



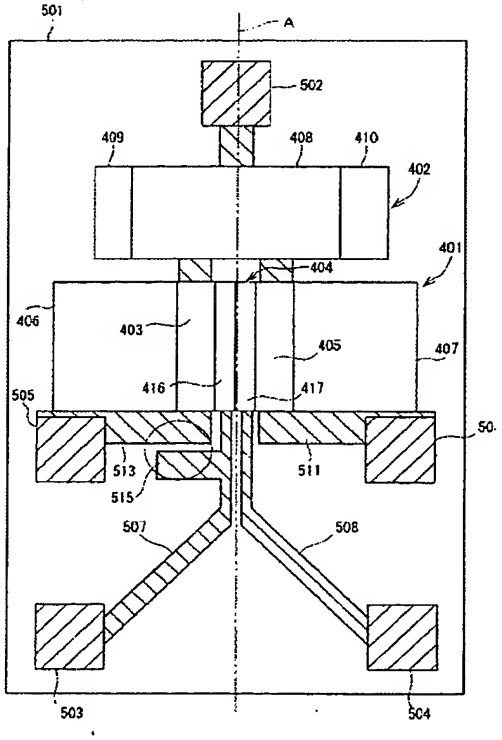
【図８】


1920
1900
1880
1860
1840
1820
1800
1780
周波数(MHz)
通過帯域
比較例1
実施例1
30
25
22
20
15
12
10
5
0
位相平衡度（度）

【図９】


501
A
502
409
408
410
402
401
404
406
403
405
407
415
417
505
507
508
503
504

【図１０】


501
A
502
409
408
410
402
401
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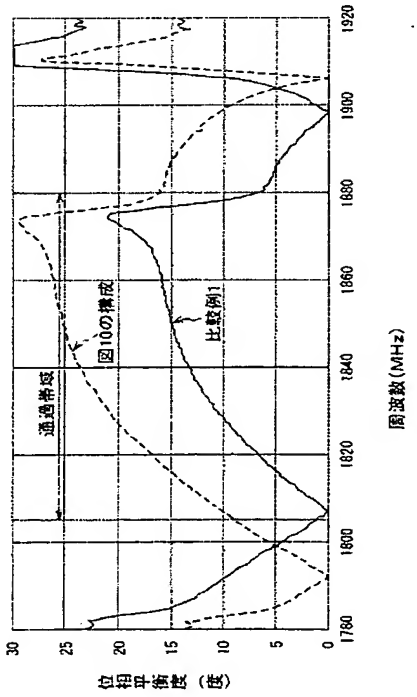
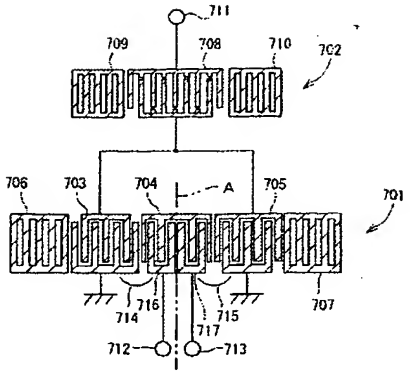
403
405
407
416
417
505
513
515
511
507
508
503
504

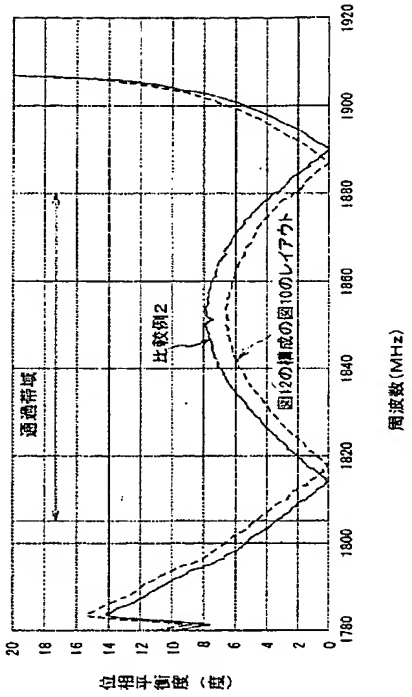
【図１１】


1920
1900
1880
1860
1840
1820
1800
1780
周波数(MHz)
通過帯域
図10の構成
比較例1
30
25
20
15
10
5
0
位相平衡度（度）

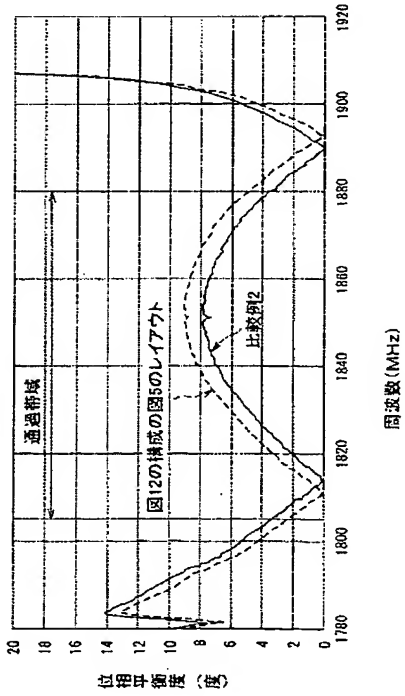
【図１２】



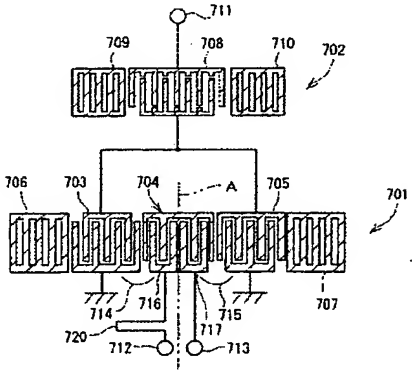
【図１３】



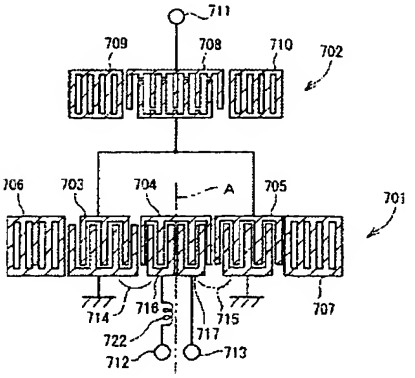
【図１４】



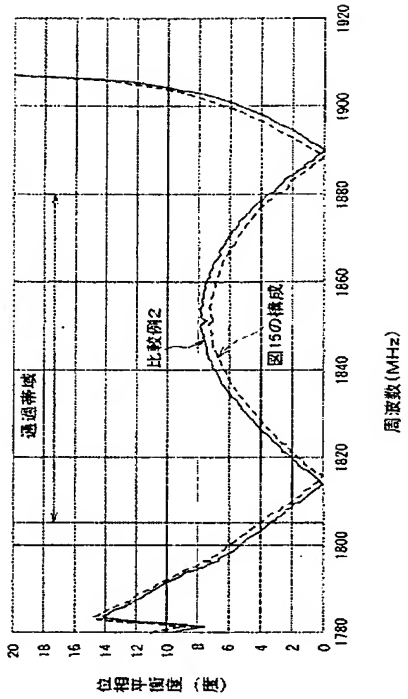
【図１５】



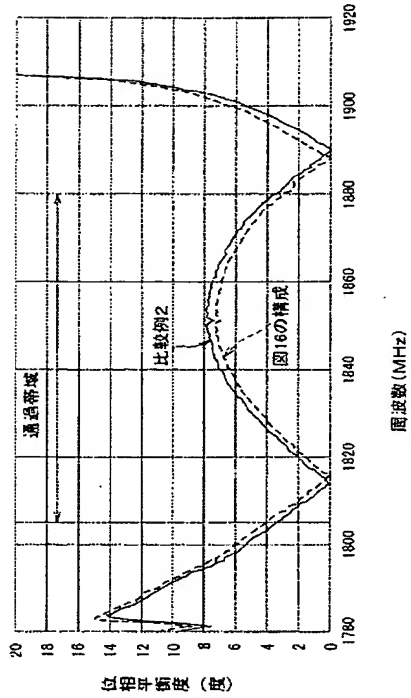
【図１６】



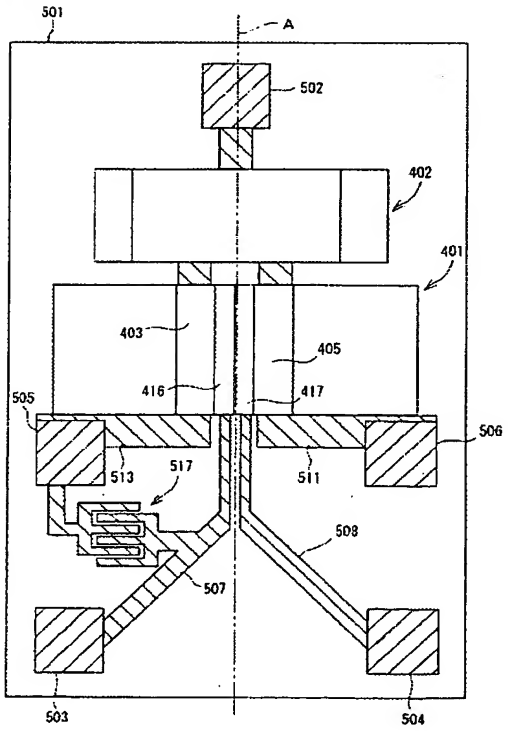
【図１７】



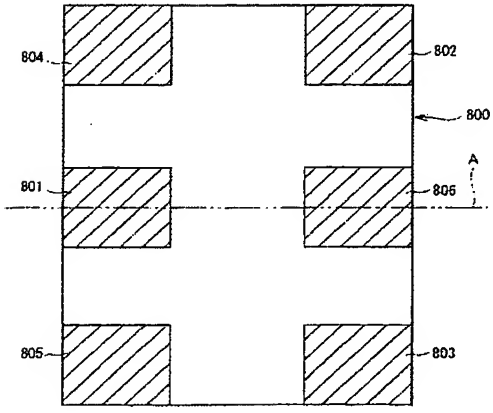
【図１８】



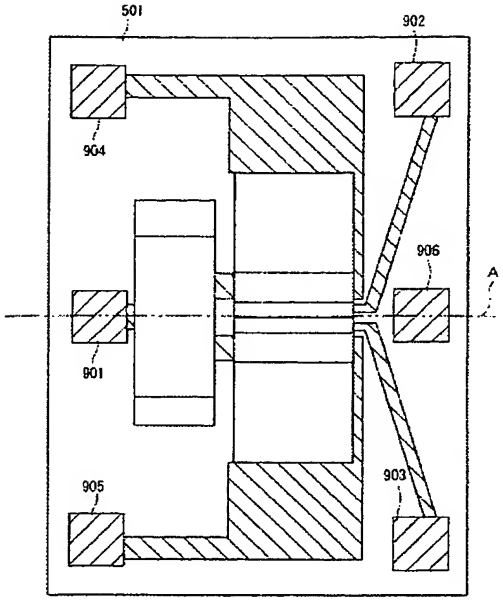
【図１９】



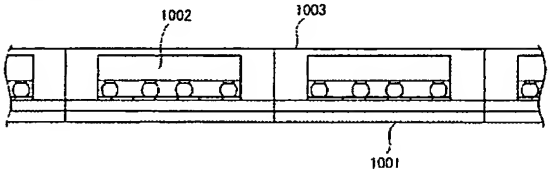
【図２０】



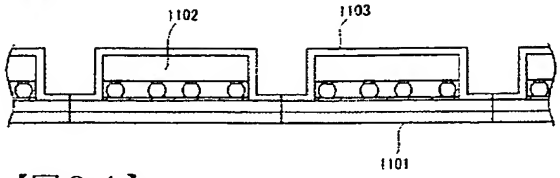
【図２１】



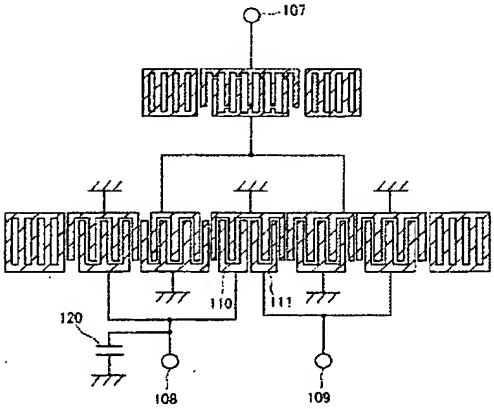
【図２２】



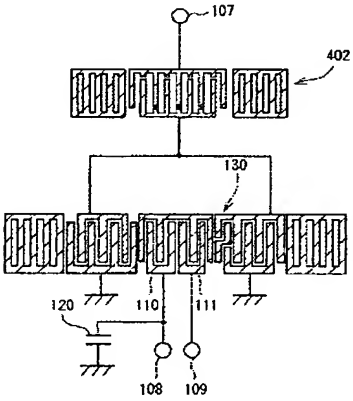
【図２３】



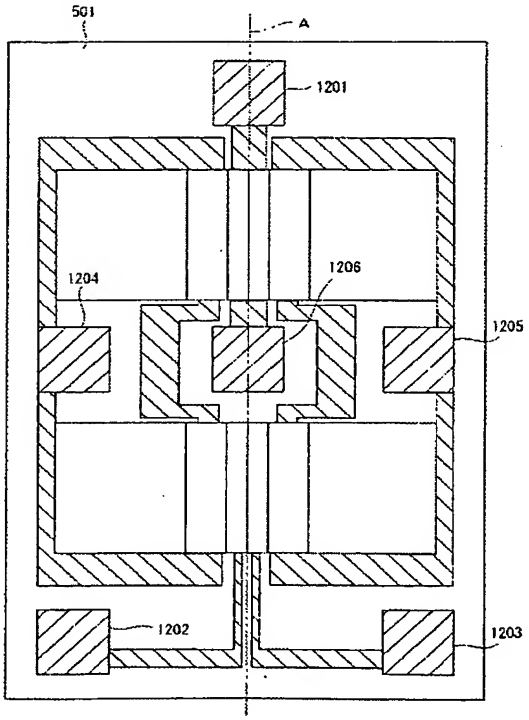
【図２４】



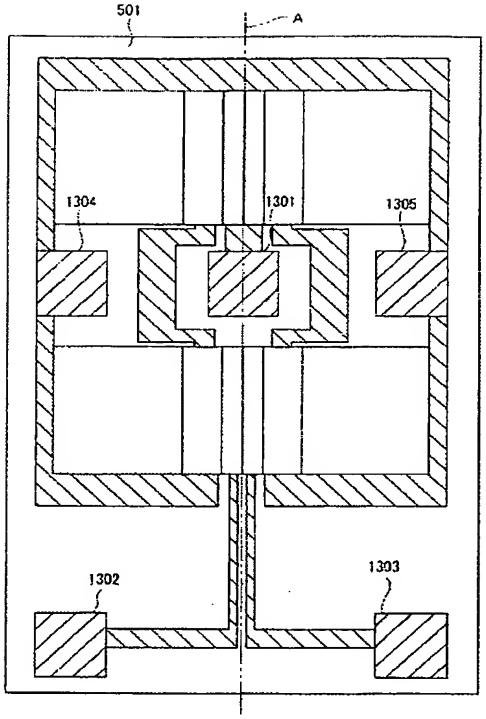
【図２５】



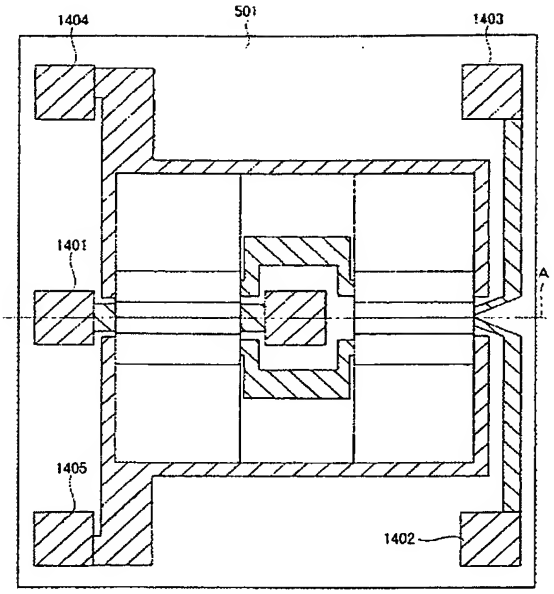
【図２６】



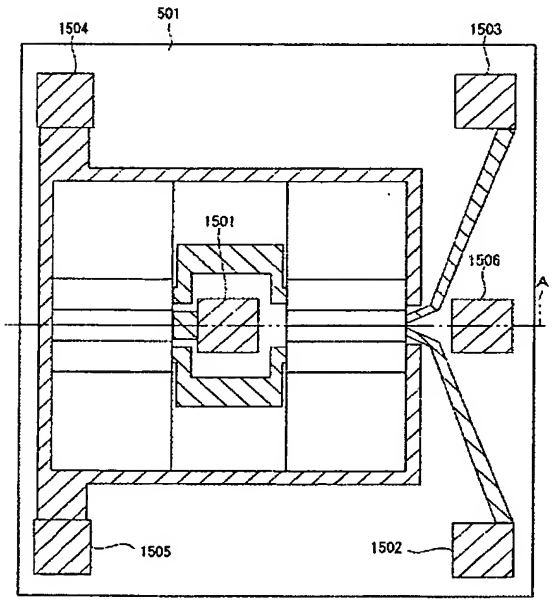
【図２７】



【図２８】



【図２９】



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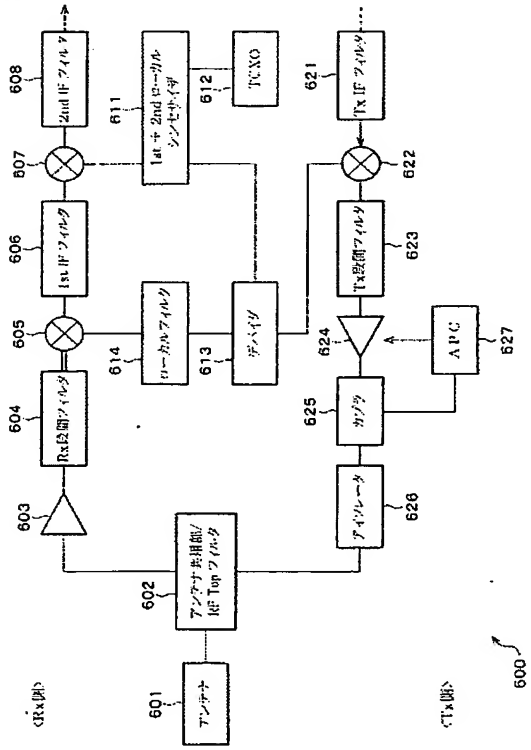
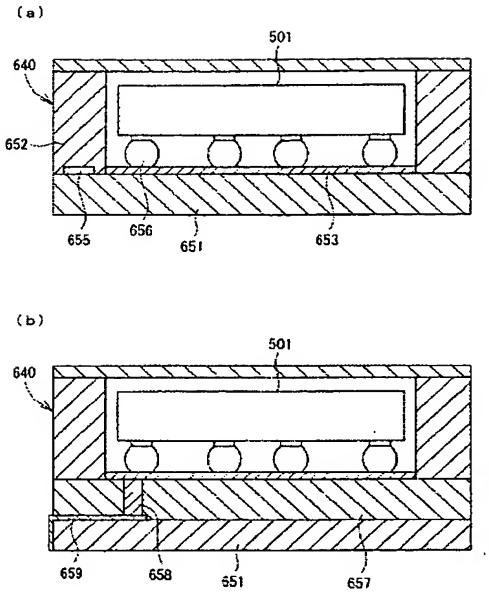


【図３１】



CLAIMS

[Claim(s)]
[Claim 1]
It has the comb mold polar zone of three or more odd number individuals formed along the propagation direction of a surface acoustic wave on the piezo-electric substrate. Are said comb mold polar zone which goes away odd pieces and is located in the center among mold polar zone, while go away, divide a mold electrode into two in the propagation direction of a surface acoustic wave, and each is connected to a balanced signal terminal. In surface acoustic wave equipment equipped with the surface acoustic wave filter of the vertical joint resonator mold which has balanced - unbalance conversion function connected to the unbalance signal terminal while two go away and the mold polar zone has the structure which adjoins the comb mold polar zone located in the center of this, and which was reversed mutually,
The outermost electrode finger of the comb mold polar zone located in said center floats, and they are an electrode or the grounded electrode. the comb mold polar zone located in said center is adjoined -- two going away and among mold polar zone Surface acoustic wave equipment characterized by forming leading-about wiring asymmetrically so that parasitic capacitance may become [the direction of the balanced signal terminal located in the side near the comb mold polar zone by which the outermost electrode finger which adjoins the comb mold polar zone located in said center is grounded] large relatively.
[Claim 2]
It has the comb mold polar zone of three or more odd number individuals formed along the propagation direction of a surface acoustic wave on the piezo-electric substrate. Are said comb mold polar zone which goes away odd pieces and is located in the center among mold polar zone, while go away, divide a mold electrode into two in the propagation direction of a surface acoustic wave, and each is connected to a balanced signal

terminal. In surface acoustic wave equipment equipped with the surface acoustic wave filter of the vertical joint resonator mold which has balanced - unbalance conversion function connected to the unbalance signal terminal while two go away and the mold polar zone has the structure which adjoins the comb mold polar zone located in the center of this, and which was reversed mutually,
The outermost electrode finger of the comb mold polar zone located in said center is a signal electrode,
Surface acoustic wave equipment characterized by to form leading-about wiring asymmetrically so that parasitic capacitance may become [the direction of the balanced signal terminal located in the side near the comb mold polar zone whose outermost electrode finger which adjoins the comb mold polar zone which adjoins the comb mold polar zone located in said center, and which goes away two and is located in said center among mold polar zone is a signal electrode] large relatively.
[Claim 3]
Surface acoustic wave equipment according to claim 1 or 2 which said piezo-electric substrate is carried in the package by flip chip bonding, and is characterized by the thing which were made into said asymmetry, and for which it takes about and wiring is formed in this package.
[Claim 4]
Surface acoustic wave equipment given in claim 1 thru/or any 1 term of 3 characterized by forming leading-about wiring of a package on said piezo-electric substrates other than said unsymmetrical leading-about wiring in the core of the comb mold polar zone located in said center at the abbreviation symmetry to the virtual shaft perpendicularly established to the propagation direction of a surface acoustic wave.
[Claim 5]
It has the comb mold polar zone of three or more odd number individuals formed along the propagation direction of a surface acoustic wave on the piezo-electric substrate. Are said comb mold polar zone which goes away odd pieces and is located in the center among mold polar zone, while go away, divide a mold electrode into two in the propagation direction of a surface acoustic wave, and each is connected to a balanced signal terminal. In surface acoustic wave equipment equipped with the surface acoustic wave filter of the vertical joint resonator mold which has balanced - unbalance conversion function connected to the unbalance signal terminal while two go away and the mold polar zone has the structure which adjoins the comb mold polar zone located in the center of this, and which was reversed mutually,
The outermost electrode finger of the comb mold polar zone located in

said center floats, and they are an electrode or the grounded electrode, Surface acoustic wave equipment characterized by adding a reactance component or the delay line to the balanced signal terminal located in the side near the comb mold polar zone by which the outermost electrode finger which adjoins the comb mold polar zone which adjoins the comb mold polar zone located in said center, and which goes away two and is located in said center among mold polar zone is grounded.

[Claim 6]

It has the comb mold polar zone of three or more odd number individuals formed along the propagation direction of a surface acoustic wave on the piezo-electric substrate. Are said comb mold polar zone which goes away odd pieces and is located in the center among mold polar zone, while go away, divide a mold electrode into two in the propagation direction of a surface acoustic wave, and each is connected to a balanced signal terminal. In surface acoustic wave equipment equipped with the surface acoustic wave filter of the vertical joint resonator mold which has balanced - unbalance conversion function connected to the unbalance signal terminal while two go away and the mold polar zone has the structure which adjoins the comb mold polar zone located in the center of this, and which was reversed mutually,

The outermost electrode finger of the comb mold polar zone located in said center is a signal electrode,

Surface acoustic wave equipment characterized by adding a reactance component or the delay line to the balanced signal terminal located in the side near the comb mold polar zone whose outermost electrode finger which adjoins the comb mold polar zone which adjoins the comb mold polar zone located in said center, and which goes away two and is located in said center among mold polar zone is a signal electrode.

[Claim 7]

Surface acoustic wave equipment according to claim 5 or 6 which said piezo-electric substrate is carried in the package by flip chip bonding, and is characterized by forming said reactance component or delay line in this package.

[Claim 8]

Surface acoustic wave equipment given in claim 5 thru/or any 1 term of 7 characterized by setting leading-about wiring on said reactance component or said piezo-electric substrates other than the delay line, and a package as the abbreviation symmetry to the virtual shaft prepared in the core of the comb mold polar zone located in said center at right angles to the propagation direction of a surface acoustic wave.

[Claim 9]

Surface acoustic wave equipment given in claim 5 thru/or any 1 term of 8 to which said reactance component is a capacitance component, and is characterized by connecting with juxtaposition between said balanced signal terminals and ground potentials.

[Claim 10]

Surface acoustic wave equipment given in claim 5 thru/or any 1 term of 8 to which said reactance component is an inductance component, and is characterized by connecting with said balanced signal terminal at the serial.

[Claim 11]

Surface acoustic wave equipment given in claim 1 thru/or any 1 term of 10 characterized by adding the surface acoustic wave resonator to a serial and/or juxtaposition to said surface acoustic wave filter.

[Claim 12]

Surface acoustic wave equipment given in claim 1 thru/or any 1 term of 11 to which said surface acoustic wave filter is characterized by plurality and carrying out cascade connection mutually.

[Claim 13]

Surface acoustic wave equipment according to claim 12 characterized by the total electrode finger number of said surface acoustic wave filter which carried out cascade connection being even.

[Claim 14]

Surface acoustic wave equipment according to claim 12 or 13 characterized by being set up so that the phases of the signal with which it connects through a signal line, respectively, and the comb mold polar zone located in each both ends of each aforementioned surface acoustic wave filter by which cascade connection was carried out transmits this each signal line may differ about 180 degrees mutually.

[Claim 15]

Surface acoustic wave equipment given in claim 1 thru/or any 1 term of 14 characterized by carrying out weighting of the electrode finger near the contiguity [in / it goes away one side at least, and / the mold polar zone] section when it is the comb mold polar zone which adjoins each other mutually among said surface acoustic wave filters.

[Claim 16]

Surface acoustic wave equipment according to claim 15 characterized by said weighting being serial weighting.

[Claim 17]

Said piezo-electric substrate is carried in the package by flip chip bonding. The external terminal of this package As opposed to the virtual shaft which is six, one unbalance signal terminal, two balanced signal

terminals, and three grounding terminals, and six terminals prepared in the core of the comb mold polar zone located in the center of said surface acoustic wave filter perpendicularly to the propagation direction of a surface acoustic wave Surface acoustic wave equipment given in claim 1 thru/or any 1 term of 16 characterized by being arranged at the abbreviation symmetry.
[Claim 18]
Said piezo-electric substrate is carried in the package by flip chip bonding. The external terminal of this package As opposed to the virtual shaft which is five, one unbalance signal terminal, two balanced signal terminals, and two grounding terminals, and five terminals prepared in the core of the comb mold polar zone located in the center of said surface acoustic wave filter perpendicularly to the propagation direction of a surface acoustic wave Surface acoustic wave equipment given in claim 1 thru/or any 1 term of 16 characterized by being arranged at the abbreviation symmetry.
[Claim 19]
The communication device characterized by having surface acoustic wave equipment of a publication in claim 1 thru/or any 1 term of 18.

[Translation done.]

* NOTICES *

DETAILED DESCRIPTION

[Detailed Description of the Invention]
[0001]
[Field of the Invention]
This invention relates to surface acoustic wave equipment equipped with the surface acoustic wave filter which has balanced - unbalance conversion function.
[0002]

[Description of the Prior Art]
The technical progress over the miniaturization of a portable telephone (communication device) in recent years and lightweight-izing has a remarkable thing. As a means for realizing this, development of the components which compounded the function of plurality [miniaturization / reduction of each component parts and] from the first has also progressed.
[0003]
Against the background of such a situation, what gave balanced - unbalance conversion function and the function of the so-called balun to the surface acoustic wave equipment used for RF stage of a portable telephone is studied briskly in recent years, and has come to be used focusing on GSM (Global System for Mobile communications) etc.
[0004]
It applies also for some patents about the surface acoustic wave equipment which gave such a balanced - unbalance conversion function. The impedance by the side of an unbalance signal terminal currently indicated by drawing 3 at JP,11-97966,A shows the surface acoustic wave equipment which the impedance by the side of 50 ohms and a balanced signal terminal gave balanced - unbalance conversion function in which it was set as 200 ohms.
[0005]
In the vertical joint resonator mold surface acoustic wave filter 301 with which the configuration of drawing 3 has the comb mold polar zone (it is called IDT Inter-Digital Transducer and the following) along three and the propagation direction of a surface acoustic wave IDT303 located in the center was divided into two in the propagation direction of a surface acoustic wave·at the abbreviation symmetry, each was connected to the balanced signal terminals 308 and 309, and each IDT 302 and 304 of the right and left which reversed the polarity is connected to the unbalance signal terminal 307. Thereby, in the above-mentioned configuration, by polar reversal, balanced - unbalance conversion function can be given and the impedance by the side of a balanced signal terminal can be further made comparatively more into about 4 times of the impedance by the side of an unbalance signal terminal for 2 minutes of IDT303.
[0006]
With the filter which has balanced - unbalance conversion function, in the transmission characteristic in the passband between an unbalance signal terminal and each terminal of a balanced signal terminal, the amplitude characteristic is equal, and it is required that the phase

should be reversed 180 degrees and it is calling it amplitude unbalance and phase unbalance, respectively.
[0007]
With amplitude unbalance and phase unbalance, the filter equipment which has said balanced - unbalance conversion function is considered to be the device of three ports. For example, amplitude unbalance =|A| [when making each of a port 1 and a balanced output terminal into a port 2 and a port 3] and A=|20log(S21) |-|20log(S31) |, phase unbalance =|B-180|, and B=|**S21-**S31| defines an unbalanced input terminal. As for such unbalance, amplitude unbalance is ideally made into 0 times in the passband of a surface acoustic wave filter, as for 0dB and phase unbalance.
[0008]
[Problem(s) to be Solved by the Invention]
However, there was a problem that unbalance was bad, in the conventional configuration shown in drawing 3 . The reason is because IDT302 differ in the polarity of the electrode finger which adjoins IDT303 mutually from IDT304 (310 and 311 of drawing 3) and parasitic capacitance, bridge capacity, etc. included in each of each balanced signal terminals 308 and 309 differ from each other mutually by this.
[0009]
The purpose of this invention is to solve the above-mentioned problem in the configuration of drawing 3 , and have balanced - unbalance conversion function in which unbalance has been improved, and offer the surface acoustic wave equipment whose impedance of a balanced signal terminal is about 4 times the impedance of an unbalance signal terminal.
[0010]
[Means for Solving the Problem]
In order that the surface acoustic wave equipment of this invention may solve the above technical problem, it has the comb mold polar zone of three or more odd number individuals formed along the propagation direction of a surface acoustic wave on the piezo-electric substrate. Are said comb mold polar zone which goes away odd pieces and is located in the center among mold polar zone, while go away, divide a mold electrode into two in the propagation direction of a surface acoustic wave, and each is connected to a balanced signal terminal. In surface acoustic wave equipment equipped with the surface acoustic wave filter of the vertical joint resonator mold which has balanced - unbalance conversion function connected to the unbalance signal terminal while two go away and the mold polar zone has the structure which adjoins the comb mold polar zone located in the center of this, and which was reversed

mutually The outermost electrode finger of the comb mold polar zone located in said center floats, and they are an electrode or the grounded electrode. the comb mold polar zone located in said center is adjoined -- two going away and among mold polar zone It is characterized by forming leading-about wiring asymmetrically so that parasitic capacitance may become [the direction of the balanced signal terminal located in the side near the comb mold polar zone by which the outermost electrode finger which adjoins the comb mold polar zone located in said center is grounded] large relatively.

[0011]

The unbalance between each balance signal terminals, especially phase unbalance are improvable by forming leading-about wiring asymmetrically so that parasitic capacitance may become [the direction of the balance signal terminal located in the side near the comb mold polar zone by which the outermost electrode finger which adjoins the comb / which adjoins the comb mold polar zone which is located in said center according to the above-mentioned configuration / mold polar zone which goes away two and is located in said center among mold polar zone is grounded] large relatively.

[0012]

In order that other surface acoustic wave equipments of this invention may solve the above technical problem, it has the comb mold polar zone of three or more odd number individuals formed along the propagation direction of a surface acoustic wave on the piezo-electric substrate. Are said comb mold polar zone which goes away odd pieces and is located in the center among mold polar zone, while go away, divide a mold electrode into two in the propagation direction of a surface acoustic wave, and each is connected to a balanced signal terminal. In surface acoustic wave equipment equipped with the surface acoustic wave filter of the vertical joint resonator mold which has balanced - unbalance conversion function connected to the unbalance signal terminal while two go away and the mold polar zone has the structure which adjoins the comb mold polar zone located in the center of this, and which was reversed mutually The outermost electrode finger of the comb mold polar zone located in said center is a signal electrode. the comb mold polar zone located in said center is adjoined -- two going away and among mold polar zone It is characterized by forming leading-about wiring asymmetrically so that parasitic capacitance may become [the direction of the balanced signal terminal located in the side near the comb mold polar zone whose outermost electrode finger which adjoins the comb mold polar zone located in said center is a signal electrode] large

relatively.
[0013]
according to the above-mentioned configuration, the comb mold polar zone located in said center is adjoined -- two going away and among mold polar zone Relatively, the direction of the balanced signal terminal located in the side near the comb mold polar zone whose outermost electrode finger which adjoins the comb mold polar zone located in said center is a signal electrode so that parasitic capacitance may become large By forming leading-about wiring asymmetrically, the unbalance, especially phase unbalance between each balanced signal terminal are improvable.
[0014]
With the above-mentioned surface acoustic wave equipment, said piezo-electric substrate is carried in the package by flip chip bonding, and leading-about wiring made into said asymmetry may be formed in this package.
[0015]
In the above-mentioned surface acoustic wave equipment, leading-about wiring of a package on said piezo-electric substrates other than said unsymmetrical leading-about wiring may be formed in the core of the comb mold polar zone located in said center at the abbreviation symmetry to the virtual shaft perpendicularly established to the propagation direction of a surface acoustic wave.
[0016]
In order that the surface acoustic wave equipment of further others of this invention may solve the above technical problem It has the comb mold polar zone of three or more odd number individuals formed along the propagation direction of a surface acoustic wave on the piezo-electric substrate. Are said comb mold polar zone which goes away odd pieces and is located in the center among mold polar zone, while go away, divide a mold electrode into two in the propagation direction of a surface acoustic wave, and each is connected to a balanced signal terminal. In surface acoustic wave equipment equipped with the surface acoustic wave filter of the vertical joint resonator mold which has balanced - unbalance conversion function connected to the unbalance signal terminal while two go away and the mold polar zone has the structure which adjoins the comb mold polar zone located in the center of this, and which was reversed mutually The outermost electrode finger of the comb mold polar zone located in said center floats, and they are an electrode or the grounded electrode. It is characterized by adding a reactance component or the delay line to the balanced signal terminal located in

the side near the comb mold polar zone by which the outermost electrode finger which adjoins the comb mold polar zone which adjoins the comb mold polar zone located in said center, and which goes away two and is located in said center among mold polar zone is grounded.

[0017]

According to the above-mentioned configuration, the unbalance, especially phase unbalance between each balanced signal terminal are improvable by having added a reactance component or the delay line to the balanced signal terminal located in the side near the comb mold polar zone by which the outermost electrode finger which adjoins the comb mold polar zone located in the center is grounded.

[0018]

In order that the surface acoustic wave equipment of further others of this invention may solve the above technical problem It has the comb mold polar zone of three or more odd number individuals formed along the propagation direction of a surface acoustic wave on the piezo-electric substrate. Are said comb mold polar zone which goes away odd pieces and is located in the center among mold polar zone, while go away, divide a mold electrode into two in the propagation direction of a surface acoustic wave, and each is connected to a balanced signal terminal. In surface acoustic wave equipment equipped with the surface acoustic wave filter of the vertical joint resonator mold which has balanced - unbalance conversion function connected to the unbalance signal terminal while two go away and the mold polar zone has the structure which adjoins the comb mold polar zone located in the center of this, and which was reversed mutually The outermost electrode finger of the comb mold polar zone located in said center is a signal electrode. the comb mold polar zone located in said center is adjoined -- two going away and among mold polar zone It is characterized by adding a reactance component or the delay line to the balanced signal terminal located in the side near the comb mold polar zone whose outermost electrode finger which adjoins the comb mold polar zone located in said center is a signal electrode.

[0019]

According to the above-mentioned configuration, the outermost electrode finger of the comb mold polar zone located in the center is a signal electrode. the comb mold polar zone located in said center is adjoined -- two going away and among mold polar zone By having added a reactance component or the delay line to the balanced signal terminal located in the side near the comb mold polar zone whose outermost electrode finger which adjoins the comb mold polar zone located in said center is a

signal electrode, the unbalance, especially phase unbalance between each balanced signal terminal are improvable.

[0020]

With the above-mentioned surface acoustic wave equipment, said piezo-electric substrate is carried in the package by flip chip bonding, and said reactance component or delay line may be formed in this package.

[0021]

In the above-mentioned surface acoustic wave equipment, leading-about wiring on said reactance component or said piezo-electric substrates other than the delay line, and a package may be set as the abbreviation symmetry to the virtual shaft prepared in the core of the comb mold polar zone located in said center at right angles to the propagation direction of a surface acoustic wave.

[0022]

With the above-mentioned surface acoustic wave equipment, said reactance component is a capacitance component and may be connected to juxtaposition between said balanced signal terminals and ground potentials. In the above-mentioned surface acoustic wave equipment, said reactance component is an inductance component and may be connected to said balanced signal terminal at the serial.

[0023]

With the above-mentioned surface acoustic wave equipment, the surface acoustic wave resonator may be added to a serial and/or juxtaposition to said surface acoustic wave filter. In the above-mentioned surface acoustic wave equipment, cascade connection of said surface acoustic wave filter may be carried out to two or more each other. It is desirable that the total electrode finger number of said surface acoustic wave filter which carried out cascade connection is even with the above-mentioned surface acoustic wave equipment.

[0024]

In the above-mentioned surface acoustic wave equipment, it is desirable to be set up so that the phases of the signal with which it connects through a signal line, respectively, and the comb mold polar zone located in each both ends of each aforementioned surface acoustic wave filter by which cascade connection was carried out transmits this each signal line may differ about 180 degrees mutually.

[0025]

With the above-mentioned surface acoustic wave equipment, weighting of the electrode finger near the contiguity [in / it goes away one side at least, and / the mold polar zone] section it is [contiguity] the comb mold polar zone which adjoins each other mutually among said surface

acoustic wave filters may be carried out. In the above-mentioned surface acoustic wave equipment, said weighting may be serial weighting.
[0026]
In the above-mentioned surface acoustic wave equipment, said piezo-electric substrate is carried in the package by flip chip bonding. The external terminal of this package It is six, one unbalance signal terminal, two balanced signal terminals, and three grounding terminals, and six terminals may be arranged at the abbreviation symmetry to the virtual shaft perpendicularly prepared in the core of the comb mold polar zone located in the center of said surface acoustic wave filter to the propagation direction of a surface acoustic wave.
[0027]
With the above-mentioned surface acoustic wave equipment, said piezo-electric substrate is carried in the package by flip chip bonding, the external terminal of this package is five, one unbalance signal terminal, two balanced signal terminals, and two grounding terminals, and five terminals may be arranged at the abbreviation symmetry to the virtual shaft perpendicularly prepared in the core of the comb mold polar zone located in the center of said surface acoustic wave filter to the propagation direction of a surface acoustic wave.
[0028]
The communication device of this invention is characterized by having surface acoustic wave equipment given in above any they are, in order to solve the aforementioned technical problem. According to the above-mentioned configuration, since it has surface acoustic wave equipment excellent in unbalance, a communication link property can be improved.
[0029]
[Embodiment of the Invention]
It will be as follows if one gestalt of operation of the surface acoustic wave equipment concerning this invention is explained based on drawing 1 . The surface acoustic wave equipment of this invention is equipped with the vertical joint resonator mold surface acoustic wave filter 101 which has three IDT(s) formed along the propagation direction of a surface acoustic wave on the piezo-electric substrate 501 as shown in drawing 1 . Divide into two IDT103 located in the center among three IDT(s) of said vertical joint resonator mold surface acoustic wave filter 101 in the propagation direction of a surface acoustic wave at the abbreviation symmetry, and each is connected to the balanced signal terminals 108 and 109. In the surface acoustic wave equipment which gave balanced - unbalance conversion function by connecting to the unbalance signal terminal 107 IDT 102 and 104 of the right and left which reversed

the polarity Or it formed on the piezo-electric substrate any of said balanced signal terminals 108 and 109 they are, it is characterized by connecting to juxtaposition the reactance component 120 which formed or carried out external to the package at the package.
[0030]
In the above-mentioned configuration, it has balanced - unbalance conversion function, and the impedance of a balanced signal terminal is about 4 times the impedance of an unbalance signal terminal, and the surface acoustic wave equipment which has improved unbalance by the reactance component 120 is obtained further.
[0031]
[Example]
(Example 1)
The configuration of the example 1 concerning this invention is explained using drawing 4 thru/or drawing 7 . In addition, future examples explain taking the case of the filter for DCS reception. First, the electrode configuration of an example 1 is explained using drawing 4 . In the example 1, the surface acoustic wave resonator 402 connected to the vertical joint resonator mold surface acoustic wave filter 401 and the vertical joint resonator mold surface acoustic wave filter 401 at the serial is formed with the aluminum (aluminum) electrode, respectively on the piezo-electric substrate 501 which consists of 40 **5-degreeYcutX propagation LiTaO3.
[0032]
Each IDT 403 and 405 is formed, respectively so that the configuration of the vertical joint resonator mold surface acoustic wave filter 401 may put IDT404 from both sides along the propagation direction of a surface acoustic wave, and each reflectors 406 and 407 are further formed in those both sides, respectively.
[0033]
IDT403 wanted to have the parallel electrode finger of each other of plurality which is prolonged in the direction which intersects perpendicularly from the band-like end face section (bus bar) and one flank of the end face section, was carried out, is equipped with two mold electrodes, and has each above-mentioned comb mold electrode in the condition of having become intricate between mutual electrode fingers so that the flank of the electrode finger of each above-mentioned comb mold electrode might be met mutually.
[0034]
In such IDT403, a signal transformation property and a setup of a passband are possible by setting up the decussation width of face which

shows the die length and width of face of each electrode finger, spacing of each adjacent electrode finger, and the confrontation die length in the condition between mutual electrode fingers of having become intricate, respectively. Moreover, IDT403 and fundamental structure are the same about each of other IDT. A reflector has the function reflected in the direction which has spread the spread surface acoustic wave.

[0035]

Moreover, with the above-mentioned configuration, the pitch of several electrode fingers by the side of the nearness of IDT403 and IDT404 and the nearness of IDT404 and IDT405 is made smaller than other parts of IDT so that it may turn out that drawing 4 is seen (414 of drawing 4 , 415 parts).

[0036]

Furthermore, it goes away in IDT404 of a center, and a mold electrode is carried out in the propagation direction of a surface acoustic wave 2 ****s, it has become each comb mold electrodes 416 and 417, and each comb mold electrode 416 and 417 is connected to each balanced signal terminals 412 and 413. Moreover, in this example 1, although a different comb mold electrode of another side which has met them from the comb mold electrodes 416 and 417 in IDT404 is used as the float electrode, the ground electrode grounded by the ground is sufficient as it. IDT405 has structure which carried out phase inversion to IDT403. Thereby, the above-mentioned configuration has balanced - unbalance conversion function.

[0037]

Each reflectors 409 and 410 are formed, respectively, one comb mold electrode of IDT408 is connected to the unbalance signal terminal 411, and the comb mold electrode of another side of IDT408 is connected to each IDT 403 and 405 so that the surface acoustic wave resonator 402 may put IDT408.

[0038]

The layout on the actual piezo-electric substrate 501 of an example 1 is shown in drawing 5 . In drawing 5 , the part corresponding to drawing 4 is shown using the same number. With the above-mentioned layout, each electrode pads 502-506 for taking a package and a flow are formed, the electrode pad 502 corresponds to the unbalance signal terminal 411, each electrode pads 503 and 504 are equivalent to the balanced signal terminals 412 and 413, respectively, each electrode pads 505 and 506 are grounding terminals, and each IDT is simplified and illustrated.

[0039]

Each electrode terminals 641-645 by the side of rear-face (shape of

rectangle) 640a of the package 640 of the abbreviation rectangular parallelepiped configuration which contained the configuration of an example 1 to drawing 6 are shown, respectively (the perspective drawing seen from the top-face side of surface acoustic wave equipment (device) shows). The electrode terminal 641 is arranged in the center of abbreviation of an edge in the longitudinal direction of rear-face 640a. Each electrode terminals 642 and 643 are arranged in both the corners of the other-end section in the longitudinal direction of rear-face 640a, respectively. Each electrode terminals 644 and 645 are arranged, respectively in the center of abbreviation of both **** in the longitudinal direction of rear-face 640a.

[0040]

They are the unbalance signal terminal by which an electrode terminal 641 is connected to the electrode pad 502, the balanced signal terminal by which each electrode terminals 642 and 643 are connected to each electrode pads 503 and 504, respectively, and the grounding terminal by which each electrode terminals 644 and 645 are connected to each electrode terminals 505 and 506, respectively.

[0041]

The surface acoustic wave equipment of an example 1 is produced using the face down method of construction which takes a flow by the bump 656 in between the electrode surface of the piezo-electric substrate 501, and the diamond touch sides 653 of a package 640, as shown in drawing 7 .

[0042]

The package 640 has the cap 654 for sticking and covering the rectangular plate-like bottom plate 651, each side-attachment-wall section 652 which adjoined mutually, respectively and was set up from each **** of a bottom plate 651, and each upper limit section of each side-attachment-wall section 652, and closing the inside of a package 640.

[0043]

The description of an example 1 is the point of trying for the earth capacity which is equivalent to the reactance component 120 shown in drawing 1 to the band-like leading-about wiring 507 which connects the comb mold electrode 417 and the electrode pad 504, and which connects the comb mold electrode 416 and the electrode pad 503 in the band-like leading-about wiring 508 to become large, as shown in drawing 5 .

[0044]

Thus, by this example 1, in order to enlarge earth capacity, the lobe 509 is formed in addition so that it may project in the method of outside on the piezo-electric substrate 501 from the leading-about

wiring 508.
[0045]
As for a lobe 509, it is desirable to be formed from the leading-about wiring 508 of the location close to the leading-about wiring 511 which connects the electrode pad 506 and IDT405 by the side of a ground.
[0046]
Moreover, as for a lobe 509, it is desirable to be prepared so that an abbreviation rectangular cross is carried out to the longitudinal direction of the above-mentioned leading-about wiring 508, and it may estrange with the above-mentioned leading-about wiring 511 to abbreviation parallel and may be extended to them to the longitudinal direction of the above-mentioned leading-about wiring 511.
[0047]
By the above-mentioned lobe 509, only about 0.16pF of earth capacity of the balanced signal terminal 413 shown in drawing 4 will become large from the balanced signal terminal 412, and, therefore, each leading-about wiring 508 and 511 will be formed asymmetrically mutually.
[0048]
At this time, each electrode finger in IDT404 (each comb mold electrodes 416 and 417) which adjoins IDT 403 and 405 is a signal electrode, respectively. The electrode finger of IDT405 which adjoins the comb mold electrode 417 connected to the electrode pad 504 made leading-about wiring with which earth capacity becomes large is also a signal electrode. The electrode finger of IDT403 which, on the other hand, adjoins the comb mold electrode 416 connected to the electrode pad 503 is a ground electrode.
[0049]
Furthermore, in the example 1, to the virtual shaft A which was shown in drawing 4 thru/or drawing 6 and which was perpendicularly established to the propagation direction of a surface acoustic wave focusing on IDT404 divided into two, the configuration of those other than the asymmetry of a lobe 509 is set up so that the layout on the piezo-electric substrate 501 and all the packages 640 may become axial symmetry. He is trying for unbalance components other than the point that IDT403 differ in the polarity of the electrode finger which adjoins IDT404 mutually from IDT405 by this not to enter.
[0050]
If the detailed design of the vertical joint resonator mold surface acoustic wave filter 401 sets to lambdaI wavelength decided by the pitch of the electrode finger which has not made the pitch small,
Decussation width of face: 78.9lambdaI

IDT number (order of 403, 404, and 405): -- (3)1919(3) / (3)26(3)
(number of the electrode finger with which the inside of a parenthesis made the pitch small)
Reflector number: 200
duty: 0.67 (IDT and reflector)
Electrode-layer thickness: 0.095lambdaI
The detailed design of the surface acoustic wave resonator 402 is as follows.
Decussation width of face: 46.5lambdaI
IDT number: 150
Reflector number: 100
duty:0.67
Electrode-layer thickness: 0.097lambdaI
Next, the operation and effectiveness about the configuration of this example 1 are explained. The phase unbalance of the configuration of an example 1 is shown in drawing 8 . As shown in drawing 9 , the configuration of an example 1, the design of surface acoustic wave equipment, the layout on the piezo-electric substrate 501, the mounting approach of a package of the example 1 of a comparison as a comparison, etc. are altogether the same except having not formed the lobe 509 which is the part where earth capacity becomes large to the example 1 of drawing 5 at the leading-about wiring 508 about the layout on the piezo-electric substrate 501, but having taken about the leading-about wiring 508, and having set it as axial symmetry to wiring 507 and the virtual shaft A. The phase unbalance of the example 1 of a comparison which changed the layout on the piezo-electric substrate 501 into nothing [lobe] is also doubled, and it is shown in drawing 8 .
[0051]
The passband of the filter for DCS reception is 1805MHz - 1880MHz. In the example 1, whenever [phase equilibrium] is improved about about 10 degrees with about 12 maxes to gaps of the phase unbalance of this passband within the limits being about 22 maxes in the example 1 of a comparison according to drawing 8 . This is adjusting so that the earth capacity of the balanced signal terminal 413 may become large, and is the effectiveness that the phase shift between the balanced signal terminal 412 and the balanced signal terminal 413 was amended.
[0052]
In the example 1, the lobe 509 which is the part where earth capacity becomes large was formed in the leading-about wiring 508. Next, with this, the lobe 515 as a part where it takes about like drawing 10 conversely, and earth capacity becomes large at wiring 507 was formed,

and phase unbalance when about 0.16pF of earth capacity of the balanced signal terminal 412 becomes large was investigated. The phase unbalance in the case of drawing 10 is shown in drawing 11 . As a comparison, the result in the case of the example 1 of a comparison shown in drawing 9 is also shown according to drawing 11 .

[0053]

When it is made for the earth capacity of the balanced signal terminal 412 to become large, phase unbalance is getting worse rather than the example 1 of a comparison conversely. Of which balanced signal terminal earth capacity is enlarged should just determine by the existence of the non-electric-field field where the method of a list, i.e., the signal electrodes, and ground electrodes of the electrode finger which adjoins each other mutually of IDT 402-404 adjoins each other mutually.

[0054]

Each electrode finger [in / in the case of an example 1 / IDT404] with which IDT 403 and 405 is adjoined is each signal electrode of each comb mold electrodes 416 and 417. The electrode finger in IDT405 which adjoins the comb mold electrode 417 which is made leading-about wiring with which earth capacity becomes large on the other hand, and which is connected to the electrode pad 504 which adjoins IDT404 is a signal electrode, and forms the signal electrode and nothing (smallness) electric-field field which are the outermost electrode finger of the comb mold electrode 417 which meets. The electrode finger in IDT403 which, on the other hand, adjoins the comb mold electrode 416 connected to the electrode pad 503 which adjoins IDT404 is a ground electrode, and forms an electric-field field with much signal electrode which is the outermost electrode finger of the comb mold electrode 416 which meets, and thing [field / above-mentioned / nothing (smallness) electric-field / electric field].

[0055]

in the case of such a list of an electrode finger, phase unbalance is improvable by setting up by the lobe 509 so that it may become large relatively from the balanced signal terminal 412 by which the earth capacity of the balanced signal terminal 413 connected to the comb mold electrode 417 which has a non-electric-field field near the outermost electrode finger (or the above-mentioned outermost electrode finger -- facing) like an example 1 is connected to the comb mold electrode 416

[0056]

Next, it investigated like drawing 12 about the case where each electrode finger which adjoins each IDT 703 and 705 of IDT704, respectively is a neutral point electrode (a float electrode or a ground

electrode is sufficient). The phase unbalance in the layout which shows the phase unbalance in the layout on the piezo-electric substrate 501 shown in drawing 13 at drawing 10 in the electrode configuration of drawing 12 (example of a complete-change form of an example 1), and is shown in drawing 14 at drawing 5 in the electrode configuration of drawing 12 (example 3 of a comparison) is shown. The phase unbalance in the layout (nothing [lobe]) shown in drawing 9 in the electrode configuration of drawing 12 as an example 2 of a comparison is also shown as an example 2 of a comparison according to drawing 13 and drawing 14 , respectively. Drawing 13 and drawing 14 are the results at the time of adjusting, respectively so that the earth capacity of about 0.02pF may go into the part of a lobe 515 and a lobe 509.

[0057]

In the case of the list of the electrode finger shown in drawing 12 , it turns out that phase unbalance is improved like the layout shown in drawing 10 by making it become large relatively from the balanced signal terminal 713 by which the earth capacity of the balanced signal terminal 712 connected to the comb mold electrode 716 is connected to the comb mold electrode 717.

[0058]

Next, in the electrode configuration of drawing 12 , the phase unbalance at the time of adding the delay line and an inductance component to unbalance to each balanced signal terminal at a serial, respectively was investigated, respectively.

[0059]

The configuration (other modifications of an example 1) which added the delay line 720 as a reactance component 120 shown in drawing 1 to drawing 15 to the balanced signal terminal 712 connected to the comb mold electrode 716 is shown, and the configuration (modification of further others of an example 1) which added the inductance component 722 as a reactance component 120 shown in drawing 1 to drawing 16 is shown.

[0060]

Drawing 15 and the phase unbalance of the case in each configuration of drawing 16 are shown in drawing 17 and drawing 18 . As a comparison, the layout of drawing 9 in the configuration of drawing 12 also shows the phase unbalance when having not added a delay-line or inductance component, either as an example 2 of a comparison respectively according to drawing 17 and drawing 18 .

[0061]

Although the concrete formation approach of the above-mentioned delay line 720 or the inductance component 722 is omitted, it is possible to

form the delay line which lengthened leading-about wiring a piezo-electric substrate top and in a package, for example, or to prepare the inductance component by the microstrip line.

[0062]

Moreover, as long as it is possible, as shown, for example in drawing 31 (a) and drawing 31 (b), respectively, you may carry out external to the location of outsides other than the interior of a package. In drawing 31 (a), the delay line and the circuit 655 used as an inductance component (reactance component) are established in the boundary part of the side-attachment-wall section 652 and a bottom plate 651, and it sets to drawing 31 (b). On a bottom plate 651, it may connect with a laminate 657 and a laminate 657 through a beer hall 658 and a beer hall 658 in the thickness direction, and the delay line formed between the bottom plate 651 and the laminate 657 and the circuit 659 used as an inductance component may be formed.

[0063]

When any of the delay line 720 and the inductance component 722 are inserted so that clearly from drawing 17 and drawing 18 , it turns out that phase unbalance has improved to the example 2 of a comparison. In addition, what is necessary is just to add the delay line 720 or the inductance component 722 to the balanced signal terminal 413 in the electrode configuration of drawing 4 conversely.

[0064]

As explained above, it has the vertical joint resonator mold surface acoustic wave filter which has three IDT(s) formed along the propagation direction of a surface acoustic wave on the piezo-electric substrate in the example 1. In the surface acoustic wave equipment which gave balanced - unbalance conversion function by dividing into two IDT located in the center among three IDT(s) in the propagation direction of a surface acoustic wave, and reversing the polarity of IDT on either side The phase unbalance of surface acoustic wave equipment is improvable by making unsymmetrical between each two balanced signal terminals earth capacity, the inductance component linked to a serial, and the reactance component that is at least one of the delay lines.

[0065]

Although how to bring the signal electrode on the piezo-electric substrate 501 close to a ground electrode was shown as it considered as the approach of enlarging earth capacity in the example 1 and was shown in drawing 5 , this may form capacity 517 with a comb mold electrode like drawing 19 . Moreover, leading-about wiring in a package 640 may be adjusted.

[0066]
Moreover, in order to lose an excessive unbalance component, it was made for the layout on the piezo-electric substrate 501 and package 640 grade to become the same to a balanced signal terminal in the example 1 except adding earth capacity, an inductance component, and the delay line asymmetrically. Therefore, although the example (refer to drawing 6) in case the number of each electrode terminals 641-645 by the side of rear-face 640a of a package 640 is five was shown, as long as this invention is a package made into axial symmetry to the virtual shaft A lengthened at right angles to the propagation direction of a surface acoustic wave such centering on not only a package but centering on the center IDT divided into two, it may use what kind of package.
[0067]
For example, in the case of the package 800 which has six electrode terminals 801-806 like drawing 20 , it can consider as axial symmetry to the virtual shaft A by using an electrode terminal 801 as an unbalance signal terminal, using each electrode terminals 802 and 803 as a balanced signal terminal, and using each electrode terminals 804-806 as a grounding terminal.
[0068]
In that case, the pattern layout on the piezo-electric substrate 501 like drawing 21 The propagation direction of a surface acoustic wave should be met in the direction of a long side of the piezo-electric substrate 501. To an electrode terminal 801, the electrode pad 902 for the electrode pad 901 on the piezo-electric substrate 501 to an electrode terminal 802 The piezo-electric substrate 501 top can also be easily made into axial symmetry to the virtual shaft A by connecting the electrode pad 903 to an electrode terminal 803, and connecting each electrode pads 904-906 to each electrode terminals 804-806 used as a grounding terminal, respectively.
[0069]
Moreover, although surface acoustic wave equipment was produced like drawing 7 in the example 1 by the approach of taking the flow of a package and a piezo-electric substrate by the face down method of construction, it is satisfactory even if this is a wire bond method of construction.
[0070]
Moreover, join the piezo-electric substrate 1002 by the flip chip method of construction on the set substrate 1001 not only like the configuration of drawing 7 but like drawing 22 as a configuration produced by the face down method of construction, and resin 1003 is

covered and closed on it. As shown in the configuration cut per 1 package by dicing, and drawing 2323 , similarly join the piezo-electric substrate 1102 by the flip chip method of construction on the set substrate 1101, and the sheet-like resin material 1103 is covered and closed on it. Surface acoustic wave equipment may be produced with the configuration cut per 1 package by dicing.

[0071]

Although the example 1 showed the configuration which carried out series connection of the surface acoustic wave resonator to the vertical joint resonator mold surface acoustic wave filter which has three IDT(s), also in the configuration to which the surface acoustic wave resonator is not connected, and the configuration by which parallel connection was carried out further, it is clear that the same effectiveness is acquired. Moreover, you may be the configuration of the vertical joint resonator mold of 5IDT which prepared IDT in the both sides of three IDT(s) further like drawing 24 .

[0072]

Moreover, even if it has given weighting like drawing 25 to the electrode finger 130 of the neighborhood where IDT adjoins each other, the effectiveness of this invention is acquired. In the configuration of drawing 25 , unbalance is improved further. As an example of weighting, although serial weighting is used in drawing 25 , this may be infanticide weighting, decussation width-of-face weighting, and duty weighting.

[0073]

Moreover, in this invention, you may be the configuration which carried out cascade connection of other vertical joint resonator mold surface acoustic wave filters 201 to the vertical joint resonator mold surface acoustic wave filter 101 like drawing 2 . As for IDT203 located in the center section of the vertical joint resonator mold surface acoustic wave filter 201, it is desirable in that case for the total electrode finger number to be even.

[0074]

Moreover, it is desirable to adjust each IDT 102 and 104 and each sense of IDT 202 and 204 so that the phases of the signal which transmits each signal lines 205 and 206 which have connected the vertical joint resonator mold surface acoustic wave filter 101 and the vertical joint resonator mold surface acoustic wave filter 201 of each other may differ about 180 degrees. The surface acoustic wave equipment which excelled [make / it / the above-mentioned configuration] in unbalance further is obtained.

[0075]
The case where it mounts in the package which has six electrode terminals shown in drawing 26 and drawing 27 at drawing 20 again about the case where it mounts in the package which has each five electrode terminals which show the example of the layout on the piezo-electric substrate 501 in the case of using the electrode configuration of drawing 2 to drawing 6 is shown in drawing 28 and drawing 29 R> 9.
[0076]
Each electrode pads 1201, 1301, 1401, and 1501 become the configuration that connect an unbalance signal terminal and each electrode pads 1202, 1203, 1302, 1303, 1402, 1403, 1502, and 1503 to a balanced signal terminal, and they connect the remainder to a grounding terminal, in that case.
[0077]
In the example 1, although 40 **5-degreeYcutX propagation LiTaO3 substrate was used as a piezo-electric substrate 501, as for this invention, the same effectiveness is acquired not only with this piezo-electric substrate 501 but with piezo-electric substrates, such as the 64 degrees - 72 degreeYcutX propagation LiNbO3 and the 41-degreeYcutX propagation LiNbO3, as the principle from which effectiveness is acquired also shows.
[0078]
Next, the communication device using the surface acoustic wave equipment of this invention used as the above-mentioned example 1 concerning this invention and either of each of that modification, or the combination of those descriptions is explained based on drawing 30 .
[0079]
As shown in drawing 30 , as a receiver side (Rx side) which receives, the above-mentioned communication device 600 is equipped with an antenna 601, the antenna common section / RFTop filter 602, amplifier 603, Rx interstage filter 604, a mixer 605, the 1stIF filter 606, a mixer 607, the 2ndIF filter 608, the 1st+2nd local synthesizer 611, TCXO (temperature compensated crystal oscillator (temperature-compensated crystal oscillator))612, a divider 613, and the local filter 614, and is constituted. As double lines showed, in order to secure balance nature from Rx interstage filter 604 to drawing 30 to a mixer 605, transmitting by each balanced signal is desirable.
[0080]
Moreover, as a transceiver side (Tx side) which transmits, it has the TxIF filter 621, a mixer 622, Tx interstage filter 623, amplifier 624, a coupler 625, an isolator 626, and APC (automatic power control)627 (APC),

and the above-mentioned communication device 600 is constituted while sharing the above-mentioned antenna 601, and the above-mentioned above-mentioned antenna common section / RFTop filter 602.

[0081]

And the surface acoustic wave equipment of this example mentioned above can use for the above-mentioned Rx interstage filter 604, the 1stIF filter 606, the TxIF filter 621, Tx interstage filter 623, and the antenna common section / RFTop filter 602 suitably.

[0082]

The surface acoustic wave equipment concerning this invention is equipped with an unbalance-balance conversion function with a filtering function, and, moreover, the amplitude characteristic and the phase characteristic between each balanced signal have the outstanding property of being near, by the ideal. Therefore, the communication device of this invention which has the above-mentioned surface acoustic wave equipment can be improving the transmission characteristic while being able to reduce the number of component parts and being able to miniaturize by having used the compound-ized above-mentioned surface acoustic wave equipment.

[0083]

[Effect of the Invention]

As explained above, the surface acoustic wave equipment of this invention It is the vertical joint resonator mold surface acoustic wave filter which has three IDT(s) formed along the propagation direction of a surface acoustic wave on the piezo-electric substrate. Divide into two IDT located in the center among three IDT(s) of said vertical joint resonator mold surface acoustic wave filter in the propagation direction of a surface acoustic wave at the abbreviation symmetry, and each is connected to a balanced signal terminal. In the surface acoustic wave equipment which gave balanced - unbalance conversion function by connecting to an unbalance signal terminal IDT of the right and left which reversed the polarity It is the configuration that the reactance component is connected [at either of said each balanced signal terminal] to the package and the package external at least one the piezo-electric substrate top.

[0084]

So, the above-mentioned configuration does the effectiveness that the unbalance between each balanced signal terminal is improvable, by connecting a reactance component to either of each balanced signal terminal.

[Brief Description of the Drawings]

[Drawing 1] It is the block diagram of the surface acoustic wave equipment of this invention.
[Drawing 2] It is the block diagram of the example of the complete-change form of the above-mentioned surface acoustic wave equipment (cascade connection).
[Drawing 3] It is the block diagram of conventional surface acoustic wave equipment.
[Drawing 4] It is the block diagram showing the electrode configuration of the surface acoustic wave equipment concerning the example 1 of this invention.
[Drawing 5] It is the top view showing the layout on the piezo-electric substrate in the surface acoustic wave equipment of the above-mentioned example 1.
[Drawing 6] It is the top view showing arrangement of each terminal by the side of the rear face of the package which contained the surface acoustic wave equipment of the above-mentioned example 1, respectively with the perspective drawing from the top-face (opposed face on the back) side of a package.
[Drawing 7] It is the sectional view of the package which contained the surface acoustic wave equipment of the above-mentioned example 1.
[Drawing 8] It is the graph which shows the phase unbalance in each configuration of the above-mentioned example 1 and the example 1 of a comparison, respectively.
[Drawing 9] It is the top view showing the layout of the surface acoustic wave equipment of the above-mentioned example 1 of a comparison.
[Drawing 10] It is the top view showing the layout of the surface acoustic wave equipment as an example 2 of a comparison.
[Drawing 11] It is the graph which shows the phase unbalance in the configuration (example 2 of a comparison) shown in drawing 10 , and each configuration of the above-mentioned example 1 of a comparison, respectively.
[Drawing 12] It is the block diagram showing the electrode configuration about the surface acoustic wave equipment as an example of a complete-change form of the above-mentioned example 1.
[Drawing 13] When the electrode configuration of drawing 12 is constituted from a layout on the piezo-electric substrate of drawing 10 , it is the graph which shows the frequency-phase unbalance of the example 2 of a comparison, respectively.
[Drawing 14] When the electrode configuration of drawing 12 is constituted from a layout on the piezo-electric substrate of drawing 5 , it is the graph which shows the frequency-phase unbalance of the example

2 of a comparison, respectively.
[Drawing 15] It is the block diagram showing the surface acoustic wave equipment of other modifications of the above-mentioned example 1.
[Drawing 16] It is the block diagram showing the surface acoustic wave equipment of the modification of further others of the above-mentioned example 1.
[Drawing 17] It is the graph which shows the configuration of drawing 15 , and the frequency-phase unbalance of the example 2 of a comparison, respectively.
[Drawing 18] It is the graph which shows the configuration of drawing 16 , and the frequency-phase unbalance of the example 2 of a comparison, respectively.
[Drawing 19] It is the block diagram showing the surface acoustic wave equipment of the modification of further others of the above-mentioned example 1.
[Drawing 20] It is the top view showing other examples about arrangement of each electrode terminal in the package of the above-mentioned example 1.
[Drawing 21] It is the block diagram showing the modification of further others of the surface acoustic wave equipment of the above-mentioned example 1.
[Drawing 22] It is the sectional view showing the 1 manufacture process of the surface acoustic wave equipment of the above-mentioned example 1.
[Drawing 23] It is the sectional view showing other manufacture processes of the surface acoustic wave equipment of the above-mentioned example 1.
[Drawing 24] It is the block diagram showing the modification of further others of the surface acoustic wave equipment of the above-mentioned example 1.
[Drawing 25] It is the block diagram showing the modification of further others of the surface acoustic wave equipment of the above-mentioned example 1.
[Drawing 26] It is the top view showing an example of the layout on a piezo-electric substrate at the time of mounting in the package which has each electrode terminal by the side of a rear face which shows the electrode configuration shown in said drawing 2 to drawing 6 .
[Drawing 27] It is the top view showing the electrode configuration shown in above-mentioned drawing 2 in drawing 6 showing other examples of the layout on a piezo-electric substrate at the time of mounting in the package which has each electrode terminal by the side of a rear face.
[Drawing 28] It is the top view showing an example of the layout on a

piezo-electric substrate at the time of mounting in the package which has each electrode terminal by the side of a rear face which shows the electrode configuration shown in said drawing 2 to drawing 20 .
[Drawing 29] It is the top view showing the electrode configuration shown in said drawing 2 in drawing 20 showing other examples of the layout on a piezo-electric substrate at the time of mounting in the package which has each electrode terminal by the side of a rear face.
[Drawing 30] It is the important section block diagram of the communication device concerning this invention.
[Drawing 31] It is the sectional view of the above-mentioned package when external [of the reactance component or the delay line at the time of containing the surface acoustic wave equipment of the above-mentioned example 1 in a package] is carried out to a package. (a) It is the example by which the circuit as the above-mentioned reactance component or the delay line was formed between a bottom plate and the side-attachment-wall section, and (b) is the example by which the above-mentioned reactance component or the delay line was formed as a circuit in the multilayer board which formed the laminate further on the bottom plate.
[Description of Notations]
101 Vertical Joint Resonator Mold Surface Acoustic Wave Filter
102, 103, 104 IDT (comb mold polar zone)
107 Unbalance Signal Terminal
108 109 Balanced signal terminal
120 Reactance Component
501 Piezo-electric Substrate

DESCRIPTION OF DRAWINGS

[Brief Description of the Drawings]
[Drawing 1] It is the block diagram of the surface acoustic wave equipment of this invention.
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[Drawing 14] When the electrode configuration of drawing 12 is constituted from a layout on the piezo-electric substrate of drawing 5 ,

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[Drawing 20] It is the top view showing other examples about arrangement of each electrode terminal in the package of the above-mentioned example 1.
[Drawing 21] It is the block diagram showing the modification of further others of the surface acoustic wave equipment of the above-mentioned example 1.
[Drawing 22] It is the sectional view showing the 1 manufacture process of the surface acoustic wave equipment of the above-mentioned example 1.
[Drawing 23] It is the sectional view showing other manufacture processes of the surface acoustic wave equipment of the above-mentioned example 1.
[Drawing 24] It is the block diagram showing the modification of further others of the surface acoustic wave equipment of the above-mentioned example 1.
[Drawing 25] It is the block diagram showing the modification of further others of the surface acoustic wave equipment of the above-mentioned example 1.
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[Drawing 27] It is the top view showing the electrode configuration shown in above-mentioned drawing 2 in drawing 6 showing other examples of the layout on a piezo-electric substrate at the time of mounting in the package which has each electrode terminal by the side of a rear face.

[Drawing 28] It is the top view showing an example of the layout on a piezo-electric substrate at the time of mounting in the package which has each electrode terminal by the side of a rear face which shows the electrode configuration shown in said drawing 2 to drawing 20 .
[Drawing 29] It is the top view showing the electrode configuration shown in said drawing 2 in drawing 20 showing other examples of the layout on a piezo-electric substrate at the time of mounting in the package which has each electrode terminal by the side of a rear face.
[Drawing 30] It is the important section block diagram of the communication device concerning this invention.
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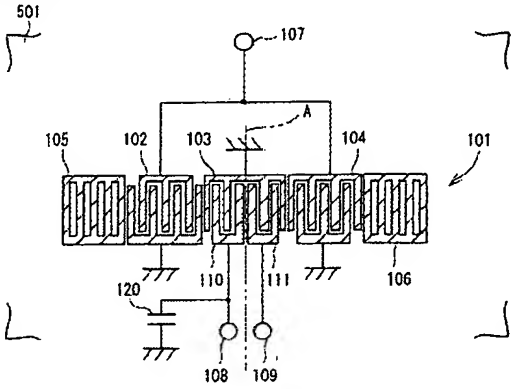
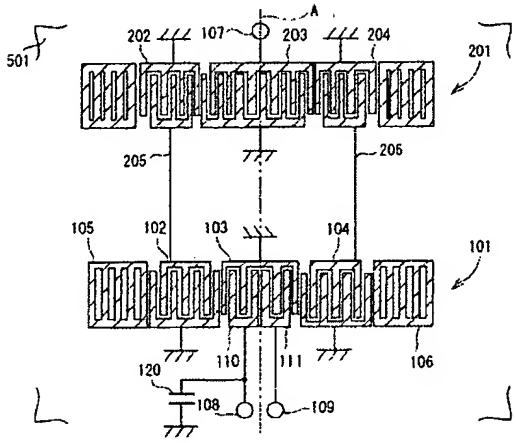
101 Vertical Joint Resonator Mold Surface Acoustic Wave Filter
102, 103, 104 IDT (comb mold polar zone)
107 Unbalance Signal Terminal
108 109 Balanced signal terminal
120 Reactance Component
501 Piezo-electric Substrate

DRAWINGS

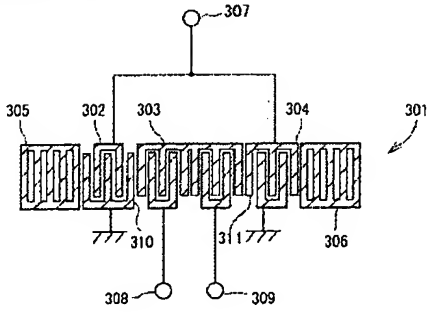
[Drawing 1]



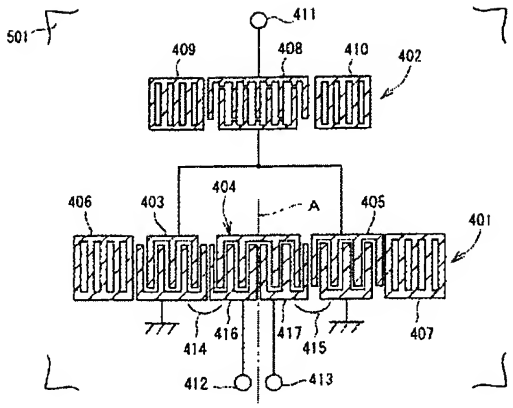
[Drawing 2]



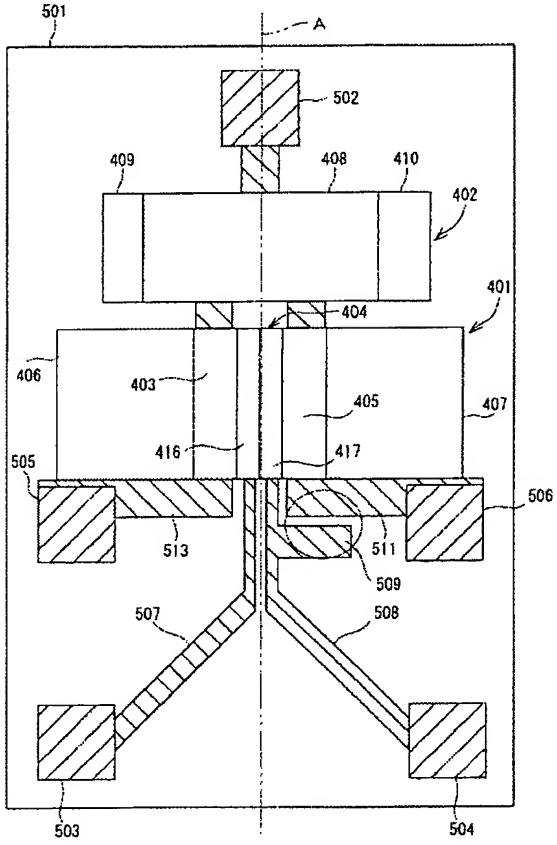
[Drawing 3]



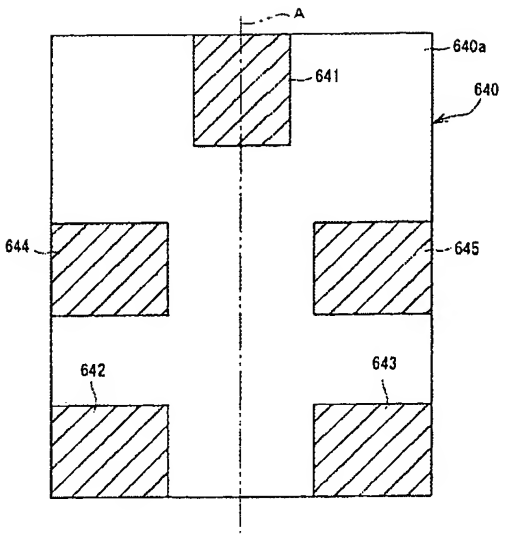
[Drawing 4]



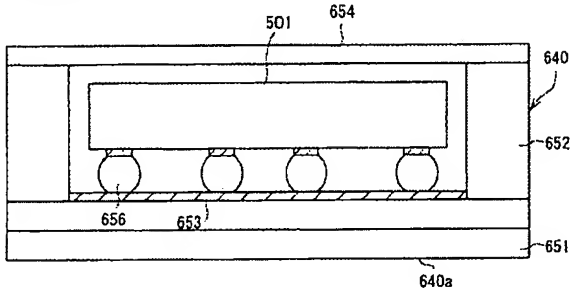
[Drawing 5]



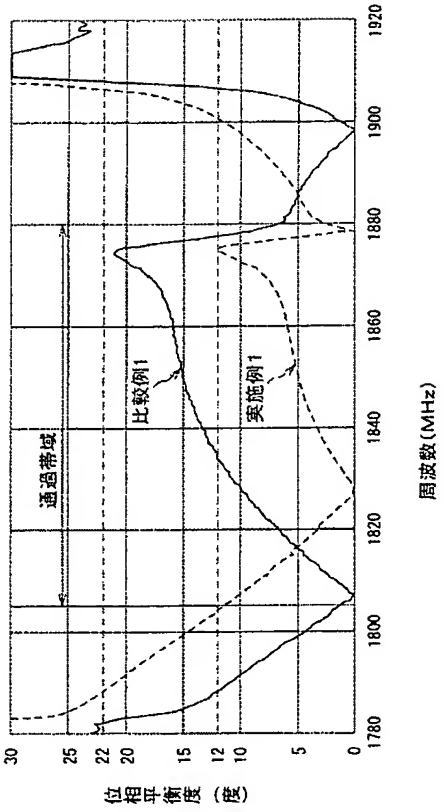
[Drawing 6]



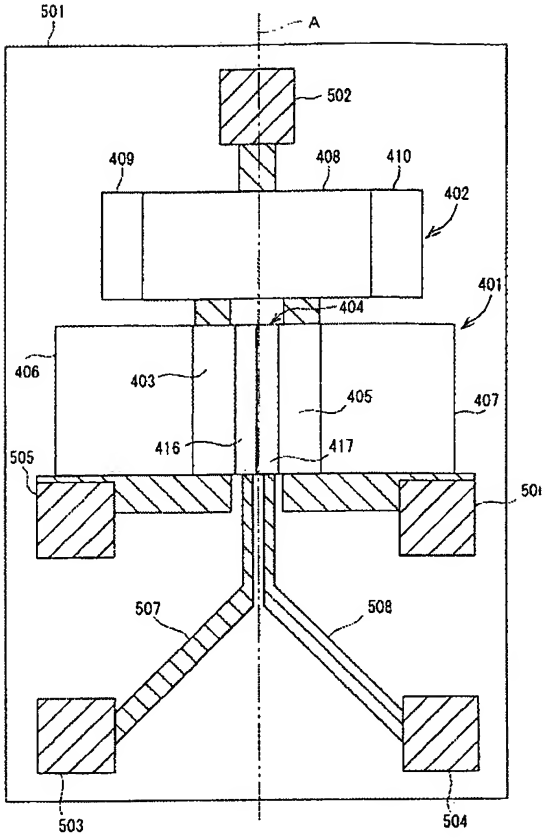
[Drawing 7]



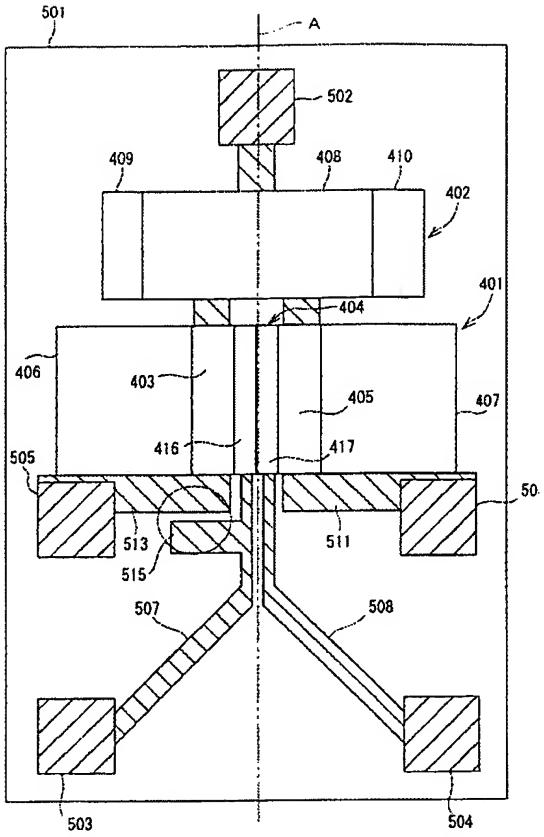
[Drawing 8]


通過帯域
比較例1
実施例1
位相平衡度（度）
周波数(MHz)
30
25
22
20
15
12
10
5
0
1780
1800
1820
1840
1860
1880
1900
1920

[Drawing 9]


501
A
502
409
408
410
402
401
404
406
403
405
407
416
417
505
507
508
503
504

[Drawing 10]


501
A
502
409
408
410
402
401
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403
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407
416
417
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513
511
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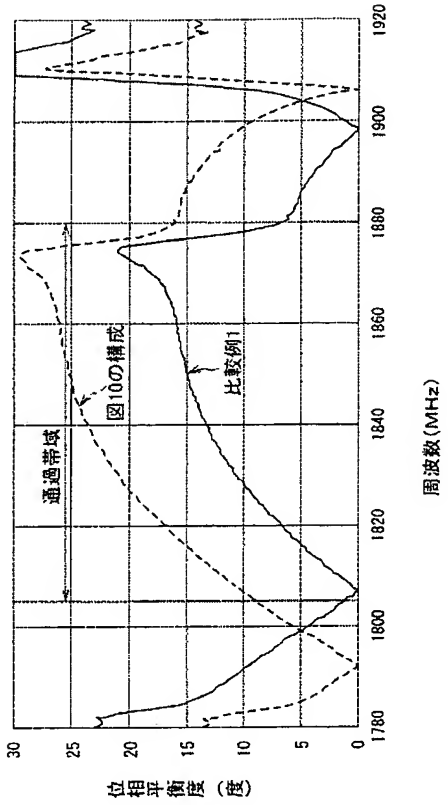
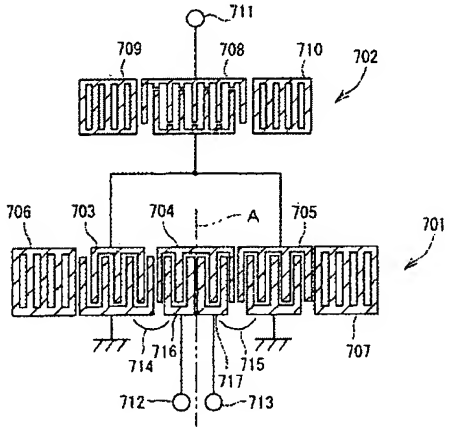
508
503
504

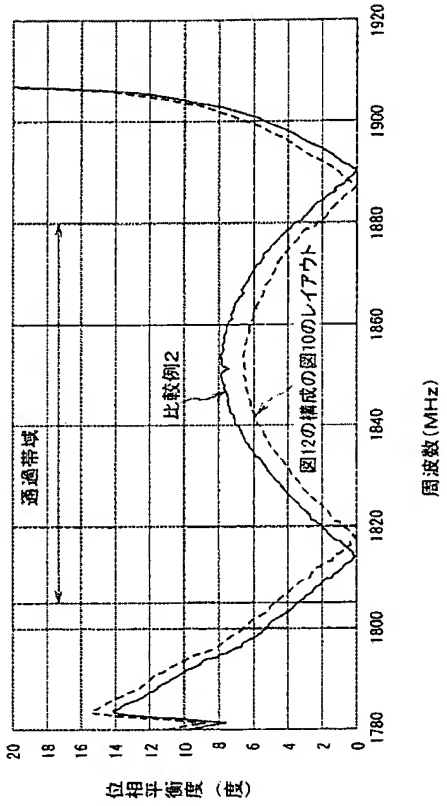
[Drawing 11]



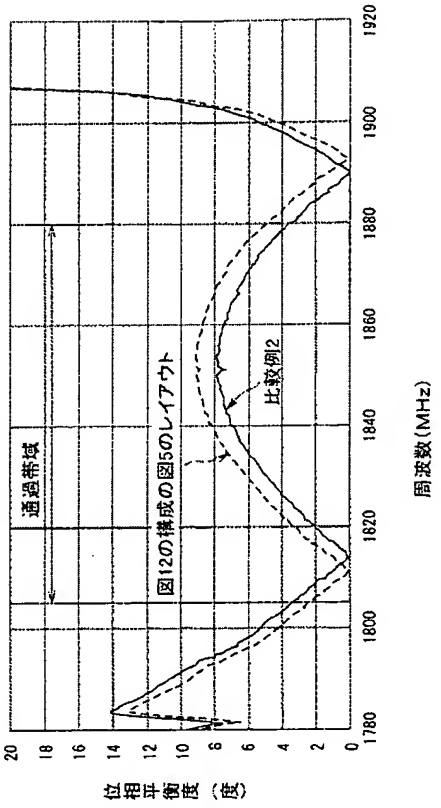
[Drawing 12]



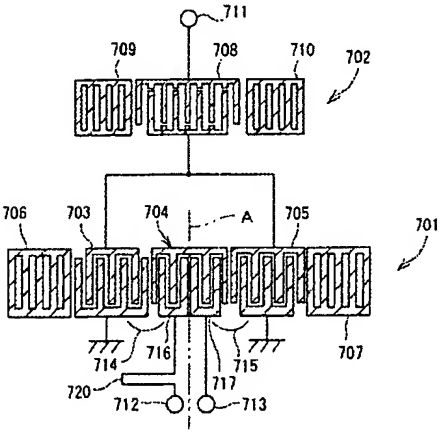
[Drawing 13]


通過帯域
比較例2
図12の構成の図10のレイアウト
位相平衡度（度）
周波数(MHz)
20
18
16
14
12
10
8
6
4
2
0
1780
1800
1820
1840
1860
1880
1900
1920

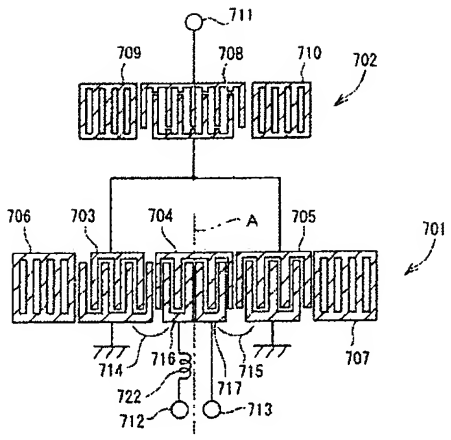
[Drawing 14]



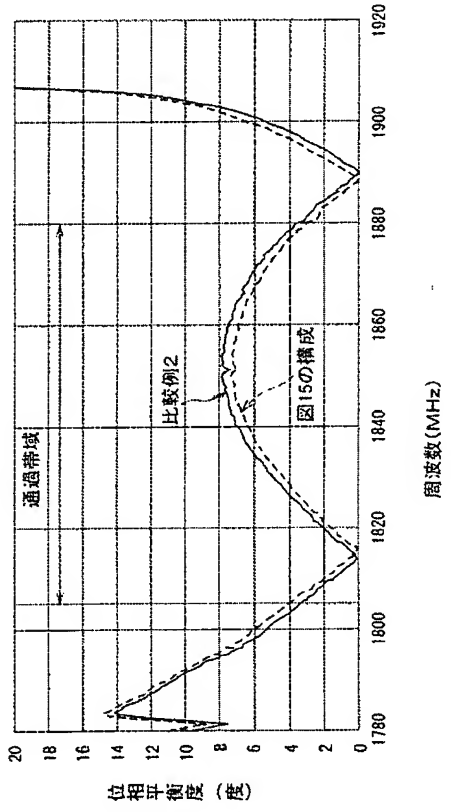
[Drawing 15]



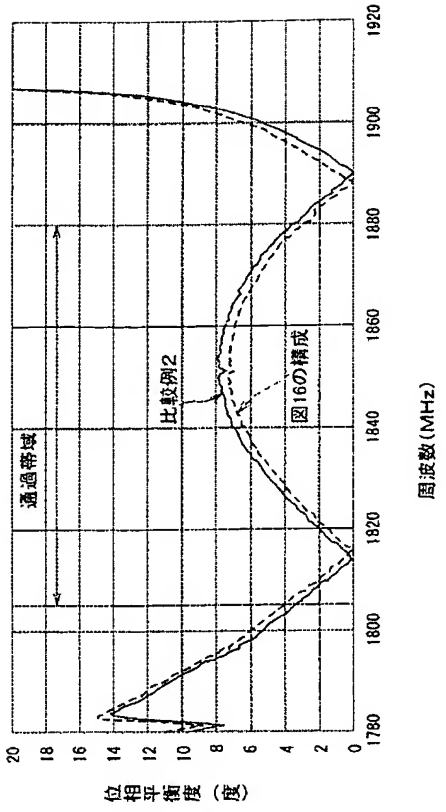
[Drawing 16]



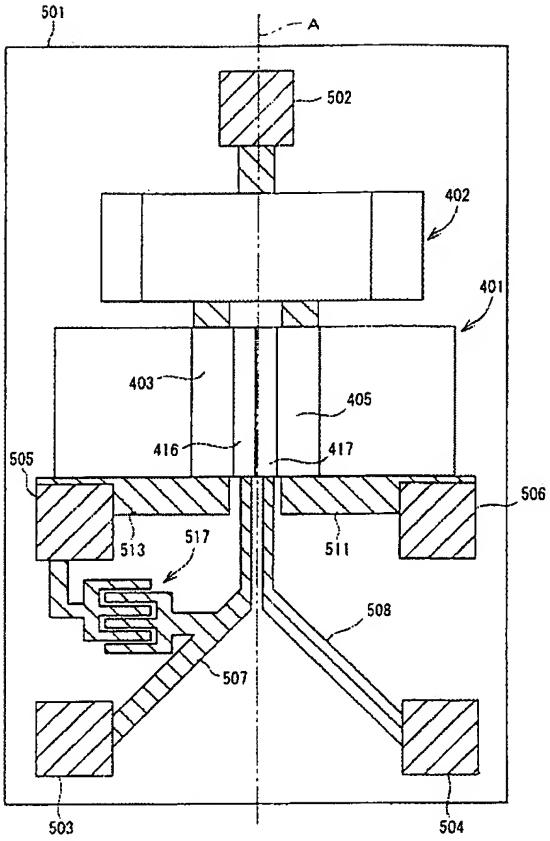
[Drawing 17]



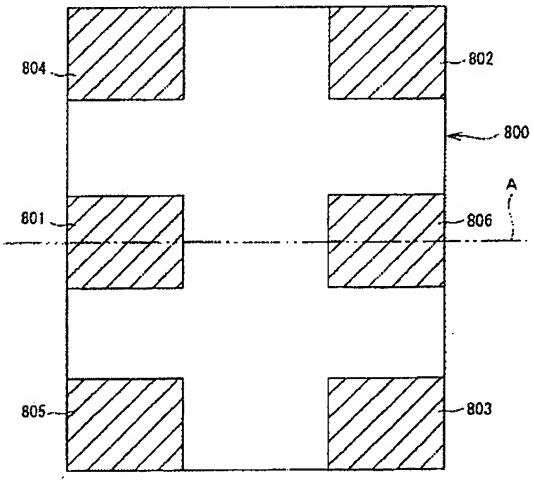
[Drawing 18]


通過帯域
比較例2
図16の構成
位相平衡度（度）
周波数(MHz)
20
18
16
14
12
10
8
6
4
2
0
1780
1800
1820
1840
1860
1880
1900
1920

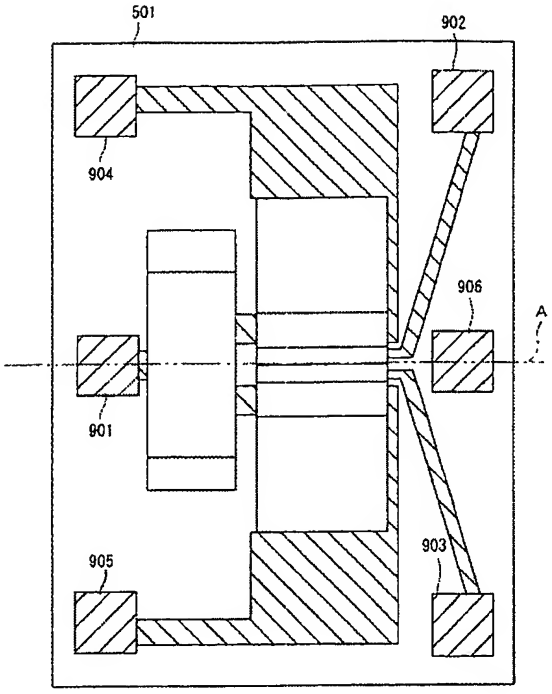
[Drawing 19]



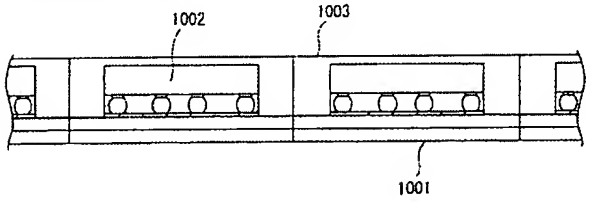
[Drawing 20]



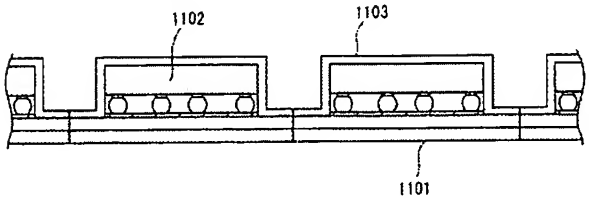
[Drawing 21]



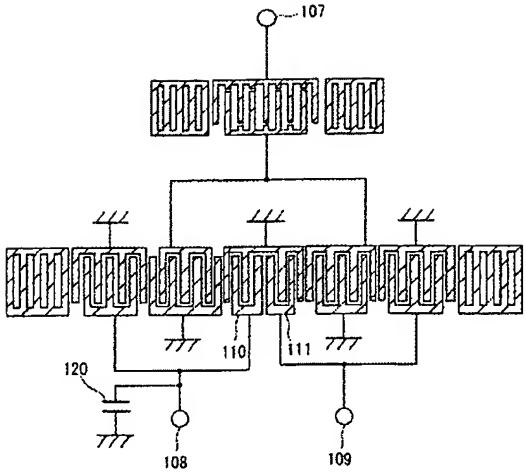
[Drawing 22]



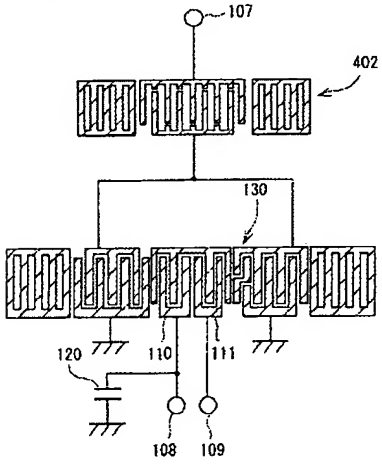
[Drawing 23]



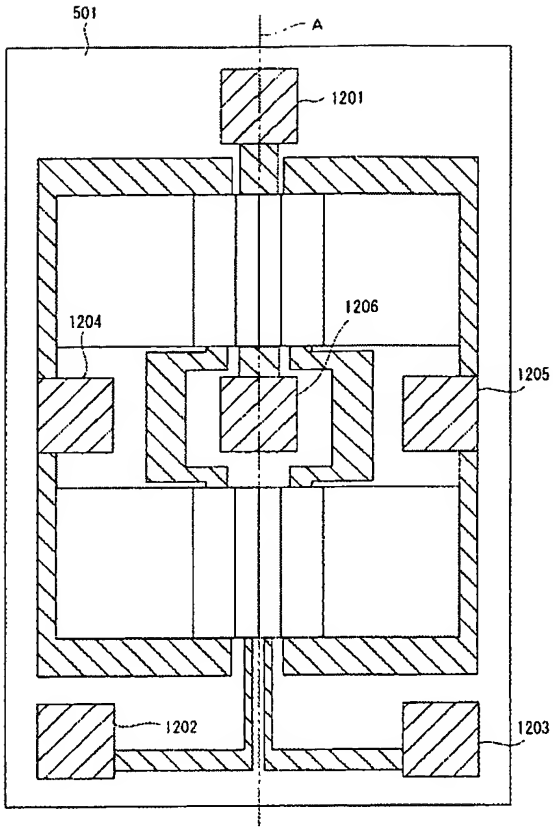
[Drawing 24]



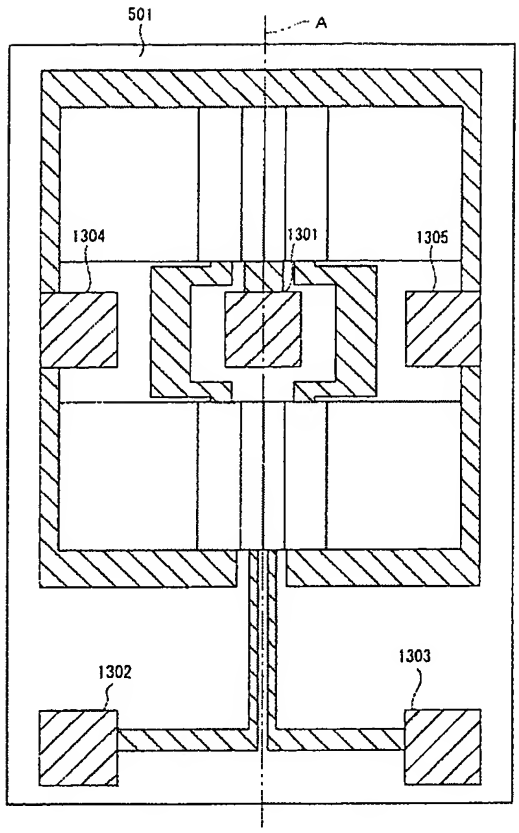
[Drawing 25]



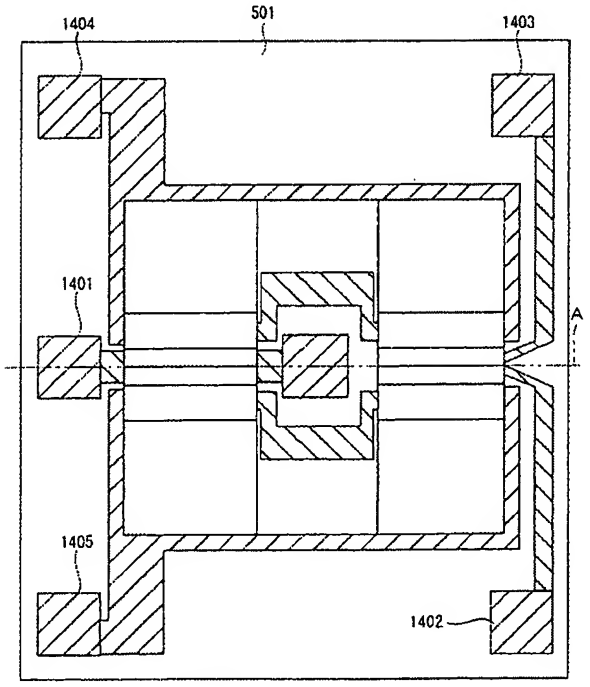
[Drawing 26]



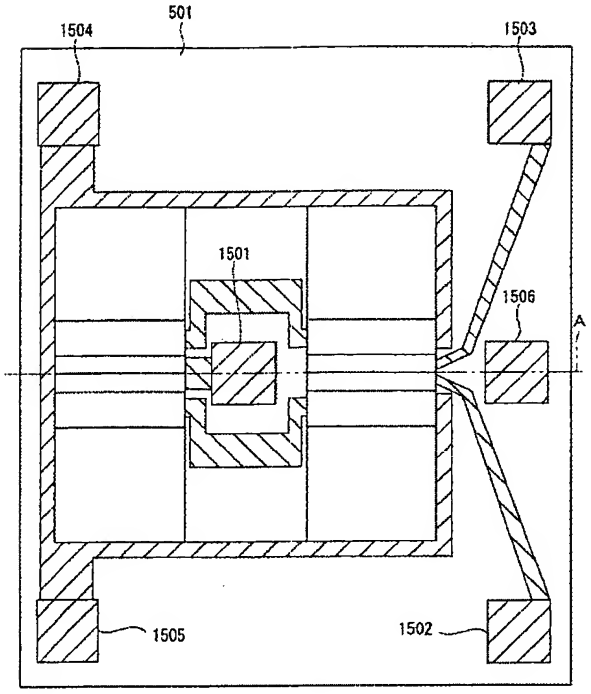
[Drawing 27]



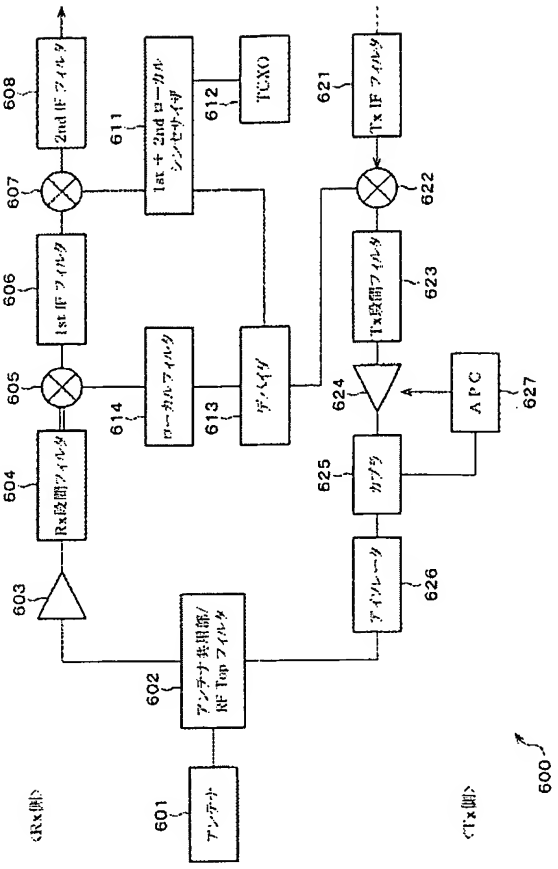
[Drawing 28]



[Drawing 29]



[Drawing 30]


601
602
603
604
605
606
607
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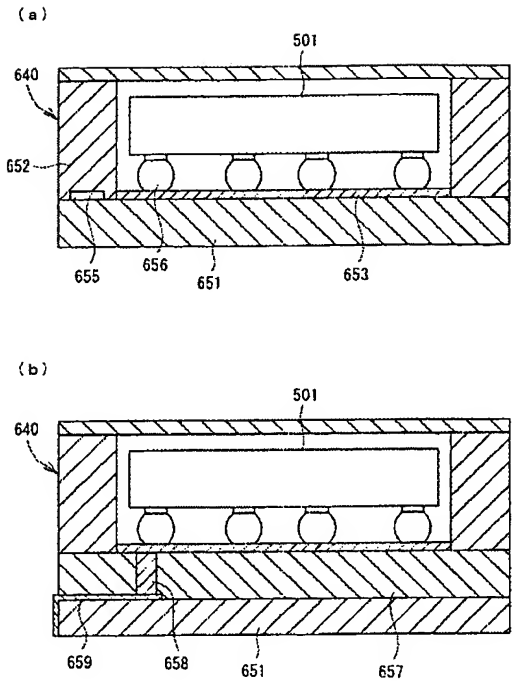
611
612
613
614
621
622
623
624
625
626
627
600
APC
TCXO

[Drawing 31]



[Translation done.]